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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

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07 AIRCRAFT PROPULSION AND POWER 1545

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For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

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Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

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Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

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18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 1558

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20 SPACECRAFT PROPULSION AND POWER 1559

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

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23 CHEMISTRY AND MATERIALS (GENERAL) N.A.

Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 1560

Includes laminates.

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Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

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Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

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28 PROPELLANTS AND FUELS 1567

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

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Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

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Includes land and global communications; communications theory; and optical communications.

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For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS N.A.
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 1661
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1662
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 1664
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1664
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1666
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1667
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1668
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 1668
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1669
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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CONTRACT NUMBER INDEX I-69
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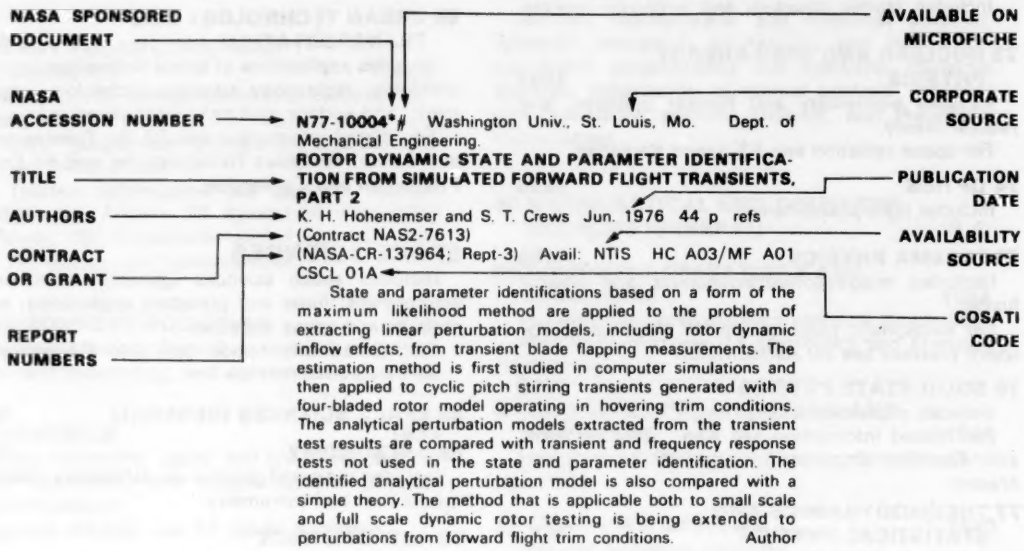
TYPICAL CITATION AND ABSTRACT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N77-10004*# Washington Univ., St. Louis, Mo. Dept. of Mechanical Engineering.
ROTOR DYNAMIC STATE AND PARAMETER IDENTIFICATION FROM SIMULATED FORWARD FLIGHT TRANSIENTS, PART 2
K. H. Hohenemser and S. T. Crews Jun. 1976 44 p refs
(Contract NAS2-7613)
(NASA-CR-137964; Rept-3) Avail: NTIS HC A03/MF A01
CSCL 01A
State and parameter identifications based on a form of the maximum likelihood method are applied to the problem of extracting linear perturbation models, including rotor dynamic inflow effects, from transient blade flapping measurements. The estimation method is first studied in computer simulations and then applied to cyclic pitch stirring transients generated with a four-bladed rotor model operating in hovering trim conditions. The analytical perturbation models extracted from the transient test results are compared with transient and frequency response tests not used in the state and parameter identification. The identified analytical perturbation model is also compared with a simple theory. The method that is applicable both to small scale and full scale dynamic rotor testing is being extended to perturbations from forward flight trim conditions. Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, AIR CARGO IN AN INTEGRATED TRANSPORTATION
J.S. DAJANI, Stanford University, Graduate School, *Palo Alto, California* 94305 (NSG 2203)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0002, STUDY OF THE THEORY OF SPAN LOADING INSTABILITIES NEAR STALL FOR WINGS OF MODERATE ASPECT RATIO
S.T. PISZKIN, General Dynamics Corporation, *San Diego, California* 92112 (DN681045; N62269-75-C-0356)

To determine a procedure for predicting and improving the non- linear longitudinal and lateral aerodynamic characteristics of wing at angles of attack about stall, leading to improvement of aircraft departure and spin resistance characteristics. The contract supports work unit NN701, agency accession no. DN481077.

Use non-linear lifting line theory, modified to include unsteady flow effects, to predict the possibility of laterally asymmetric span load distributions leading to large rolling and yawing moment at stall angles of attack. Compare results of theory with T-2C aircraft wind-- tunnel and flight tests.

ADDENDA: Supporting agency address is: Naval Air Development Center, Air Vehical Technology Dept., Warminster, Pa.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0003, AERODYNAMICS PARAMETERS AFFECTING TURBOPROPELLER PERFORMANCE
J.P. SULLIVAN, Purdue University, Graduate School, *Lafayette, Indiana* 47907 (NSG 3135)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0004, DIELECTRIC LAYER FILTER
UNKNOWN, Raytheon Company, *Bedford, Massachusetts* 01730 (DF246660; F19628-76-C-0189)

AF function - satellite-to-aircraft communication. Deficiency - improved antenna performance by spacially filtering grating lobes inherent with widely spaced array elements. Objective - to determine a general method for locating pass and stop zones to eliminate any possible grating lobe combinations. How research contributes - elimination of grating lobes allows large arrays to be made using less elements, reducing array cost, weight, and complexity.

The approach is to seek out innovative general mathematical techniques that will provide specific pass regions and stop regions in angle. This is an angular synthesis problem.

ADDENDA: Supporting agency address is: AF Cambridge Research Laboratories LZ, L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0005, AIRCRAFT DESIGN SYNTHESIS UTILIZING INTERACTIVE COMPUTER GRAPHICS
R.A. KROEGER, Univ. of Michigan, Graduate School, *Ann Arbor, Michigan* 48104 (NSG 2206)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0006, CRASHWORTHINESS AND OCCUPANT PROTECTION IN GENERAL AVIATION AIRCRAFT ACCIDENTS
R.G. SNYDER, Univ. of Michigan, Highway Safety Research Inst., *Ann Arbor, Michigan* 48105 (106343 (HRB NO.))

OBJECTIVES: To determine relationships between injury patterns and crashworthiness design.

SIGNIFICANCE: These investigations, conducted since 1970, are being pursued in cooperation with the National Transportation Safety Board, the Federal Aviation Administration, and the Michigan State police. The on-scene investigations provide the kind of biomedical data essential for safer designs of aircraft, particularly with respect to improved protection during and following a crash. After a crash, investigators examine and evaluate the performance of cabin structures, instrument panels, restraint systems, seats, and other components relative to occupant injury or protection. Evaluations thus far indicate that even when cabin structures remain intact, occupants often receive serious or fatal injuries from instrument panel projections, inadequate restraint systems, inadequately anchored seats, and other design-related causes. The data show that use of upper torso restraints could reduce serious and fatal injuries in survivable accidents by an estimated 85%. The data also show that emergency general aviation aircraft ditching can be successfully accomplished under adverse conditions, with overall 95% survivability found for 315 cases in the past 10 years.

ADDENDA: Document provided to S.S.I.E. by the H.R.I.S.

SUPPORTED BY University of Michigan

1.0007, AIR POLLUTION ABATEMENT FOR JET ENGINE TEST SYSTEMS
W.P. SULE, U.S. Navy, Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN696016; N00156-74-C-1717)

To define technology and develop hardware for the effective control of particulate and gaseous chemical emissions resulting from ground run- up testing of gas turbine engines.

Survey existing technology for the possible application of commercial techniques and conduct R/D efforts in those areas which appear most promising for the test cell problem.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, ANALYSIS OF DATA FROM THE HELIUM VECTOR MAGNETOMETERS ON THE PIONEERS 10 AND 11 SPACECRAFT
P.J. COLEMAN, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (NSG 7295)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

2.0002, CONTINUATION OF THE STUDY FOR DEVELOPMENT OF ATS AND COMMUNICATIONS TECHNOLOGY SATELLITE USER EXPERIMENTS HISTORY
N.A. ENGLER, Univ. of Dayton, School of Engineering, *Dayton, Ohio* 45409 (NAS 3-20392)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, MEASUREMENTS OF MATERIALS PROPERTIES FOR SOLAR CELLS
J.G. CASTLE, Univ. of Alabama, School of Science & Engin., *Huntsville, Alabama* 35807 (NAS 8-32398)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0002, THE COLLISION DYNAMICS AND ENERGETICS OF HYPERTHERMAL REACTIVE GASES WITH CHEMICAL SPECIES ABSORBED ON CATALYTIC METAL SURFACES
R.J. MADIX, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NSG 1381)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0003, PRELIMINARY STUDY OF RETICULATED FOAM SURVIVABILITY CHARACTERISTICS
H. SHARFSTEIN, Calif. State Univ. & Colleges, School of Engineering, *San Jose, California* 95114 (NSG 2200)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0004, TO DEVELOP A METHOD FOR DECONVOLUTION OF GAS CHROMATOGRAPHIC DATA
G.H. RAYBORN, Univ. of Southern Mississippi, School of Science & Technology, *Hattiesburg, Mississippi* 39401 (NSG 1380)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0005, LASER AUGMENTED REACTION RATES - APPLICATION TO INTERCONVERSIONS AND OXIDATION OF BORANES AND CARBORANES 14152-C
S.H. BAUER, Cornell University, School of Arts & Sciences, *Ithaca, New York* 14853 (DA0E9222; DAAG29 76 G0327)

To study reaction kinetics and mechanisms of gas-phase interconversions and oxidation of boranes and their derivatives with emphasis on laser-induced processes. Relevance - since the next generation (approximately 8-year period) of missile fuels will involve hydroborane/carborane additives, any technique to produce these compounds in reasonable quantities at reasonable costs is relevant to MICOM's program.

A gas-phase kinetics investigation of the elementary steps which characterize the pyrolysis, condensation, and chain building of boranes will be carried out with the following techniques: (a) laser irradiation to selectively augment reaction rates and (b) the use of low-pressure flow reactors, with microwave or laser excitation, coupled with spectroscopic and/or mass spectrometric diagnostics.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, N.C. 27709

SUPPORTED BY U.S. Dept. of Defense - Army

3.0006, MATERIAL GROWTH AND CHARACTERIZATION DIRECTED TOWARD IMPROVING III-V HETEROJUNCTION SOLAR CELLS
W.E. ALEXANDER, North Carolina A & T St. Univ., School of Engineering, *Greensboro, North Carolina* 27411 (NSG 1390)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0007, SPECTROSCOPIC INVESTIGATION OF THE EFFECTS OF MOISTURE ON EPOXY RESINS
J.L. KOENIG, Case Western Reserve Univ., School of Engineering, *Cleveland, Ohio* 44106 (NSG 3140)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0008, FAULT TREE ANALYSIS OF TENSILE FAILURE OF FIBROUS COMPOSITES
M.R. LOUTHAN, Virginia Poly. Inst. & St. U., Graduate School, *Blacksburg, Virginia* 24061 (NSG 1382)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0009, INTERACTION OF CHLORINE AND HYDROGEN CHLORIDE WITH ALUMINA, ASBESTOS, AND SILICA
J.P. WIGHTMAN, Virginia Poly. Inst. & St. U., School of Arts & Sciences, *Blacksburg, Virginia* 24061 (NSG 1389)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, STUDY OF UNSTEADY HYDRO- AND AERODYNAMICS OF LIFTING SURFACE OF HIGH ASPECT RATIO WITH CURVED CENTER LINE
H.K. CHENG, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (ENG75-21425)

An unsteady lifting surface theory will be developed for platforms of high aspect ratio, taking into account the sweep and the curvature of the center (lifting) line. The resulting formulation reveals significant departure from the classical theory in three-dimensional (3- D) effects in the form of strong local corrections and in the influence of the far wake. A fundamental feature brought out unambiguously by the general theory is the self-averaging effect of the high-frequency components incuding those in the unit Strouhal number range; namely, the 3-D effect contributed by the far wake, which depends (globally) on the spanwise circulation distribution, averages itself out to zero (or to a negligible quantity), as soon as the wavelength (based on the frequency and the flow speed) is short compared with the wing span. However, the local 3-D corrections associated with the

sweep and curvature remain important in all frequency ranges. Specific areas of investigation are: 1) 3-D effects on lift, moment, thrust, propulsive efficiency and wake energy, and their control. 2) Analysis in the lower frequency ranges. 3) Computations by vortex-lattice and other numerical methods to verify accuracy of theory and to explore its potential for correlating unsteady wind data.

SUPPORTED BY U.S. Natl. Science Foundation

4.0002, AUTOMATED ANALYSIS SYSTEM FOR HZE PARTICLE TRACE DOSIMETERS
E.V. BENTON, Univ. of San Francisco, School of Science, *San Francisco, California* 94117 (NAS 9-15152)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0003, RESEARCH OF MICROWAVE SEMICONDUCTOR DEVICES
T.N. BHAR, Howard University, Graduate School, *Washington, District of Columbia* 20001 (NSG 5158)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0004, BASIC RESEARCH RELEVANT TO A CW-NUCLEAR PUMPED LASER
R.T. SCHNEIDER, State University of Fla. Sys., School of Engineering, *Gainesville, Florida* 32611 (NSG 7299)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0005, INVESTIGATION OF THE 1.15 MICRON PHOTOCONDUCTIVE RESPONSE OF SILICON DEVICES
H.P. LANYON, Worcester Polytechnic Inst., School of Engineering, *Worcester, Massachusetts* 01609 (NSG 3137)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0006, DROPLET MOTION INDUCED BY WEAK SHOCK WAVES
S. TEMKIN, Rutgers the State University, School of Engineering, *New Brunswick, New Jersey* 08903 (ENG76-15045)

A two-year experiment will be undertaken to study the unsteady motion of small liquid droplets responding to the passage of a weak shock wave pulse inside which the pressure profile varies linearly, i.e., an N-wave. The experiments will be conducted in an existing shock-tube facility which will be modified to produce the desired profile. Water droplets with diameters in the range 5-500 microns will be exposed to the N-wave. Their displacement and deformation will be recorded photographically by means of single-frame photography using a high-intensity, high-flashing-rate stroboscope. The recorded trajectories will be used to compute the droplet velocity and drag. The experiments will be conducted for Reynolds numbers in the range of 10- 100, where the effects of unsteadiness on the motion appear to be more pronounced.

This is a renewal of NSF Grant ENG73-03725.

SUPPORTED BY U.S. Natl. Science Foundation

4.0007, NEW RADIOMETERS FOR BALLOON 3 K ISOTROPY EXPERIMENT
D. WILKINSON, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (NSG 7302)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0008, EFFECTS OF TURBULENCE AND FLOW ON TEMPERATURE AND FLOW FIELDS IN TIME-VARYING AXIAL-FLOW ARCS
D.M. BENENSON, State University of New York, School of Engin. & Appl. Sci., *Buffalo, New York* 14214 (ENG76-17009)

The research program is directed towards (1) the increased understanding of the basic interactions involving turbulence, mainstream flows (to supersonic), and the plasma and (2) the relevance of these phenomena to applications, e.g., circuit interruption and plasma chemical processing. The effects of turbulence and high-speed flows (to supersonic) upon the temperature and flow fields of dynamic (e.g., ramped) plasmas will be determined. Temperature diagnostics for axial- flow and cross-flow columns will be applied and extended to determine spatial and temporal resolved distributions of temperature for arcs in such flow environments. Turbulence effects will be studied both quantitatively and qualitatively. Laser velocimetry methods will be applied to determine the flow field in dynamic and steady-state arcs in high-speed flows (to supersonic) and in turbulent flows.

Analysis of a ramped axial-flow arc in a converging-diverging nozzle will be carried out to determine the effects of turbulence and high-speed flow. Numerical solutions of a fairly complete set of equations of motion will include the influence of turbulence, flow (to supersonic), pressure level, initial current level, current ramp, realistic gas properties, radiation, etc. Results will include the dynamic behavior of the temperature, flow, and pressure fields, voltage gradient, arc resistance, and arc size.

SUPPORTED BY U.S. Natl. Science Foundation

4.0009, PROGRAM OF RESEARCH IN THE STUDY OF QUANTUM FLUIDS
J.D. REPPY, Cornell University, School of Arts & Sciences, *Ithaca, New York* 14853 (DMR75-08624 A02)

The research program on the superfluid properties of He4 supported by GH-37658 will be continued. During the three years of this grant the program will be extended to the two new superfluid phases of He3. These experiments will first concentrate on the phenomena associated with fourth sound, persistent currents, and viscosity.

SUPPORTED BY U.S. Natl. Science Foundation

4.0010, HIGH-RESOLUTION MULTI-FREQUENCY RADAR/RADIOMETER DATA ANALYSIS
D.B. HODGE, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (NAS 5-23850)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0011, DEVELOPMENT OF ROBERTSON-BERGER SUNBURNING ULTRAVIOLET METER COMPUTER COMPATIBLE READOUT MODIFICATION
UNKNOWN, Temple University, Graduate School, *Philadelphia, Pennsylvania* 19122 (NAS 9-15207)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0012, NEW INFRARED DETECTORS AND SOLAR CELLS
A. SHER, Coll. of William & Mary, School of Arts & Sciences, *Williamsburg, Virginia* 23185 (NSG 1385)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, MICROWAVE SYSTEMS FOR IN-SITU MEASUREMENT OF WETNESS OF SNOW AND EARTH
UNKNOWN, Univ. of California, Graduate School, *Berkeley, California* 94720 (NCA 2-50704)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0002, SUNSET METEOROLOGICAL RADAR
J.L. GREEN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8DJ4 27 52)

PROJECT OBJECTIVE: To operate and further develop a large VHF pulse Doppler scatter radar and other instruments at the Sunset field in order to measure winds, waves and turbulence in the troposphere and lower stratosphere. To analyze these measurements in terms of tides, waves, turbulent transport, etc., in order to improve the understanding of the dynamics of the atmosphere.

CURRENT YEAR PLAN: Conduct observations of the dynamics of the lower atmosphere, including: the velocity structure of the jet stream, gravity waves, mountain lee waves and turbulence. Analyze waves for energy and momentum transport and generating mechanism. Deduce turbulent diffusion coefficient from measurement of turbulence. Study radar scattering mechanism. Further develop radar for simultaneous measurements in four directions for study of spatial properties of atmospheric phenomena. Perform comparative experiments with aircraft and balloons.

PROGRESS REPORT: Detected gravity waves in the 4-15 km region by variations in wind velocity and found a peak-to-peak amplitude as great as 15 m/s and periods of two minutes and longer. The velocity structure of the jet stream was mapped as it passed overhead. Radar was improved to measure wind velocity at 16 simultaneous altitudes and in any of six directions sequentially, which allows the measurement of total wind vector. A tracking radar was installed for balloon and aircraft experiments.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0003, STRATOSPHERIC MONITORING
A.L. SCHMELTEKOPF, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8DJ4 40 83)

PROJECT OBJECTIVE: Conduct an experimental program to monitor the long-term changes in the concentrations of stratospheric constituents which are found to have the potential for upsetting the stratospheric ozone balance.

CURRENT YEAR PLAN: A comprehensive critical species measurement program will be continued to obtain altitude profiles, study temporal variations (both systematic, e.g., seasonal, solar cycle, etc., and non- systematic of at least non-correlated variations) and study geographical variability. Several techniques will be used to carry out this program, i.e., grab samples, flyable Gas Chromatograph, resonance fluorescence, optical absorption and laboratory rate constant measurements.

PROGRESS REPORT: Twenty balloon flights into the stratosphere were made during FY 76 to obtain grab samples. These were analyzed for N2O, F11 and F12. Large variability of the profiles was found with both time and location. Not enough data are available yet to make a systematic analysis, but it is sure that any analysis will have to include general circulation as well as chemistry in its program.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0004, DETERMINATION OF HIGHLY REFLECTIVE CLOUD FREQUENCIES OVER THE TROPICAL OCEANS
C.S. RAMAGE, Univ. of Hawaii, School of Arts & Sciences, *Honolulu, Hawaii* 96822 (NSG 5159)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0005, RESEARCH ON STRUCTURE AND MOTION OF THE OCEANS
R. PATCHEN, U.S. Dept. of Commerce, Off. of Marine Surveys & Maps, *Rockville, Maryland* 20852 (833315)

OBJECTIVE: To investigate the structure, velocity, and extent of estuarine and ocean currents; to enhance understanding of the dynamics of water motion and the interaction of atmospheric forces on water movement parameters; to support NOAA oceanographic services; to improve capability to predict the movement of water, heat, and pollutants.

APPROACH: Analysis of water movement data in estuarine and nearshore regions and related scientific investigations; development and verification of hydrodynamic modeling using data collected by NOS; use of satellite altimeter data to determine oceanic tides and sea surface slopes, particularly along continental boundaries.

PROGRESS: Development of a vertically integrated, two-dimensional hydrodynamic model to be applied to Cook Inlet, Alaska.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0006, CLIMATE PROCESSES IN THE ATMOSPHERE AND OCEAN
R.S. LINDZEN, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (NSG 5160)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0007, EXPERIMENTAL FIELD - LABORATORY STUDY OF POPULATIONS OF SCIOMYZIDAE, DISTRIBUTION OF TETANOCERA
C.O. BERG, Cornell University, Agric. Experiment Station, *Ithaca, New York* 14850 (0041157; 1090-12142-002-A)

OBJECTIVE: Analyze population dynamics of the snail-killing marsh fly, Sepedon fuscipennis, and to map the distribution of species of Tetanocera (Sciomyzidae).

APPROACH: Elements of the population dynamics of Sepedon fuscipennis will be studied in 4 artificial ponds at Cornell University, Ithaca, New York. Experimental laboratory studies of S. fuscipennis will determine the effects of various constant temperatures on rates of development, fecundity, mortality, and population growth. Unidentified specimens of Tetanocera will be determined. These data and previously accumulated information will be used in preparing maps of the known distribution of Tetanocera species. The information will be prepared in manuscript form for eventual publication.

PROGRESS: The study of interactions between Sepedon fuscipennis and its snail prey in 4 experimental marshes has continued. Weather conditions were recorded daily, and snails of 7 species found in 88 quadrat samples were measured for estimates of biomass. Populations of adult flies were estimated by a capture-recapture technique, and 135 quadrats were examined for eggs, larvae, and pupae. Aerial photography of the study site during 3 different seasons documents differences in vegetation density that will enable us to reduce sampling errors by sampling the highly aggregated snails along gradients of vegetation density. Data for the construction of life tables of S. fuscipennis are being collected from a large colony maintained under various temperatures in constant-temperature chambers. Durations of all developmental stages are recorded, and individual pairs of adults are observed from emergence to death to determine fecundity and life span. Field collections of flies, fly larvae, and puparia made in January-March in Upstate New York have disclosed that most sciomyzid flies pass the winter as pupae; one species, as embryonated eggs; one species, as mature larvae; and three species, as hibernating adults. Flies caught on mild days in January survived in screen cages left outside during winter snows and sub-freezing temperatures. In April, they fed, mated, and laid viable eggs.

SUPPORTED BY U.S. Dept. of Agriculture - A.R.S. - B.A.R

5.0008, EVALUATING SATELLITE IMAGERY FOR INVENTORYING LAND USE AND NATURAL RESOURCES (ERTS-A)
E.E. HARDY, Cornell University, Agric. Experiment Station, *Ithaca, New York* 14850 (0063027; NYC-147311)

OBJECTIVE: Evaluate degree of accuracy with which land use and natural resources can be classified and inventoried using

imagery obtained from satellites as the major source of input information.

APPROACH: Using simulation techniques, degradable images will be produced with levels of capability that allow separation of only land and water. Improvements in quality, controlled and calibrated, will then be generated, determining at what point on a quality scale different land uses can be determined. Interpretation relies on quality of resolution and scale relationships. These will be the guidelines in generating this information. Satellite imagery, provided by NASA, will be used for classification and inventorying of land use and resources in various parts of the state. Field checking to determine accuracy attained will be carried out. Some new techniques that rely on hardware will be tested. A Kohler light source will be used for negative enhancement. A 'color slicer' will be used and tested as a means of speeding up general classification techniques. A Zoom Transfer Scope will be used to accommodate the great changes in scale we anticipate.

PROGRESS: The objective of this study was to evaluate the possibility of using multipsectral imagery from the Earth Resources Technology Satellite to inventory different land uses in New York State. Emphasis was on developing special low-cost photographic processes to enhance land use categories. Diazo color composites were used to interpret these categories. Maps were made of central New York Adirondacks and Long Island at a scale of 1:62,500. Interpretation and data take-off were manual, required little technical skill and low cost. Accuracy overall approaches 85%. The techniques described would be useful worldwide, especially where cost and technical staff skills are important factors.

SUPPORTED BY New York State Government - Albany

5.0009, INTERDISCIPLINARY APPLICATIONS AND INTERPRETATIONS OF REMOTELY SENSED DATA
G.W. PETERSEN, Penn. State University, Agric. Experiment Station, *University Park, Pennsylvania* 16802 (0061072; PEN01998)

OBJECTIVE: Develop a background in processing and interpretation of the type of data that will be available from the two Earth Resources Technology Satellites and Earth Resources Experimental Package on SKYLAB.

APPROACH: Data interpretation and analysis will be conducted ranging from photointerpretation to various forms of computer processing. Initially this will involve nine bands of multispectral scan imaging data covering 0.38 to 1.0 microns and one band of infrared imaging data covering 8 to 13 microns along with a 70 mm tracking color stereo photo set. The flight line is one for which extensive ground truth is readily available and which contains wide variations in vegetation, soils and geological formations.

PROGRESS: In an interdisciplinary effort, through the Office for Remote Sensing of Earth Resources (ORSER), The Pennsylvania State University has been involved in analyzing Landsat-1 data from the Susquehanna River Basin in Pennsylvania. Combining various imagery analysis techniques and programs developed for use on the Penn State IBM 370/168 computation system, ORSER has developed a sophisticated processing system for the analysis of satellite and aircraft photography & MSS imagery & digital data. ORSER has also shown the significance and feasibility of applying these data to projects involving natural resource and land use inventories, geology and hydrology, and problems of environmental quality. Large areas of the Susquehanna River Basin have been mapped from the digital data with seven generalized land use categories: water, urban, disturbed land (e.g., strip mines, quarries), pasture, cropland, forest, and 'other.' Geologic bedrock structures, and lineaments -- of significance, in groundwater resource studies, engineering, and mineral prospects--have been mapped from Landsat-1 imagery. Environmental problems such as strip mines and coal refuse piles, and damage to vegetation by insects and air pollution, have been delineated from ERTS digital data.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0010, REMOTE SENSING OF EARTH RESOURCES FOR PROCESSING OF U-2 AND LANDSAT SCANNER DATA
UNKNOWN, Penn. State University, Graduate School, *University Park, Pennsylvania* 16802 (NAS 5-23859)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0011, MEASUREMENT OF THE HYDROLOGIC SOIL-COVER COMPLEX WITH AIRBORNE SCATTEROMETERS
B.J. BLANCHARD, Texas A & M University System, Graduate School, *College Station, Texas* 77843 (NSG 5156)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0012, REGIONAL PLANNING & RESOURCE MANAGEMENT - APPLICATIONS OF MONITORING AGRICULTURAL LAND USE UTILIZING REMOTE SENSING
B.J. NIEMANN, Univ. of Wisconsin, Agric. Experiment Station, *Madison, Wisconsin* 53706 (0062731; WIS01906)

OBJECTIVE: Evaluate the use of remote sensing (near infrared photography .7- .9 microns), thermal 8. - .2 microns and sensing platforms including conventional, high-altitude and satellite systems as a data source for agriculture and rural land use planning. Emphasis will be placed on the detection of resources for inclusion in the projected state-wide spatial resource data bank.

APPROACH: With the assistance of a remote sensing technical/liason committee, data needs potentially applicable for detection by remote sensing will be identified. Interpreted data will be compared with ground truth supplied by the technical/liason committee or by comparing with either of three existing spatial computer data banks.

PROGRESS: During the past year the site of the investigation of applications of remote sensing in monitoring agricultural patterns was shifted from the Green Bay-Milwaukee area to Northwest Wisconsin. This shift was consummated to take advantage of recent RB-57 (1:120,000) photography available and test its usefulness in a different geographical context. Data from the RB-57 photography is presently being interpreted on a random basis for approximately 600, 10-acre parcels. Preliminary results indicate comparable favorable detection results with that of the Green Bay-Milwaukee test site.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, PROTEOLYTIC CONVERSIONS OF PITUITARY GROWTH HORMONES
UNKNOWN, Univ. of California, Graduate School, *Berkeley, California* 94720 (NCA 2-50703)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0002, BONE DENSITY BY PHOTON ABSORPTIOMETRY
J.M. VOGEL, Univ. of California, School of Medicine, *Davis, California* 95616 (NAS 9-15203)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0003, QUANTITATIVE MEASUREMENT OF RIGHT AND LEFT VENTRICULAR CHAMBER GEOMETRY USING RADIOOPAQUE ENDOCARDIAL MARKERS
E. CARLSSON, Univ. of California, School of Medicine, *San Francisco, California* 94122 (NCA 2-665707)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0004, QUANTITATIVE DETERMINATION OF DIASTOLIC LEFT VENTRICULAR PROPERTIES
S.A. GLANTZ, Univ. of California, Graduate School, *San Francisco, California* 94122 (NCA 2-665708)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0005, STUDY OF THE EFFECT OF HYPOGRAVIC AND HYPERGRAVIC STIMULI ON THE HUMAN OTOLITH SYSTEM
G.C. QUARTON, Univ. of Michigan, School of Medicine, *Ann Arbor, Michigan* 48104 (NAS 2-9466)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0006, THE ROLE OF CELL MEMBRANES IN THE REGULATION OF LIGNIFICATION IN PINE CELLS
D.L. HENDRIX, Univ. of Houston, Graduate School, *Houston, Texas* 77004 (NSG 7300)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, A DATABASE SYSTEM TO SUPPORT IMAGE ALGORITHM EVALUATION
Y.E. LIEN, Univ. of Kansas, School of Liberal Arts & Sci., *Lawrence, Kansas* 66045 (NSG 8046)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

7.0002, AUTOMATED DOCUMENT MONITORING AND CONTROL PROGRAM FOR SOFTWARE DEVELOPMENT
D.B. SIMMONS, Texas A & M University System, School of Engineering, *College Station, Texas* 77843 (NAS 5-23827)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, SMALL SOLID PARTICLES IN BEAMS
W.D. KNIGHT, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (DMR75-22607 A01)

Research on the electronic properties of small metallic particles, previously supported under DMR-7202980 AO3, will be continued. In order to eliminate effects due to the matrix in which the metal particles are embedded, a beam of particles will be constructed, and magnetic, electric, and optical experiments will be performed on them as they fly. It is expected that the particles containing odd numbers of electrons may be deflected in inhomogeneous magnetic fields in the manner of the Stern-Gerlach experiment, and that any particle may be deflected in inhomogeneous electric fields. Refocusing of the beams as in the experiment of Rabi, with various resonance experiments imposed between the focusing and refocusing fields, will allow sensitive measurements of magnetic moments, electric polarizabilities, optical properties, energy levels and g-factors as well as hyperfine effects. Very homogeneous particle size distributions can be obtained, and precise measurement of the solid and surface properties of the particles can be made, including relaxation times relative to the time flight of the particles in the beam. The method is applicable over a wide range of particle sizes ranging from a few atoms in 'clusters' to 'small particles' containing a thousand atoms or more.

SUPPORTED BY U.S. Natl. Science Foundation

8.0002, THEORETICAL HIGH-ENERGY PHYSICS
R.E. NORTON, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (PHY76-23467)

Research activities will include work on: Classical Solutions of Non-Abelian Gauge Theories; Neutral Currents; Neutrino Physics; Statistical Physics; Infrared Confinement; Dynamical Symmetry Violation; Mathematical Physics; Lepton Induced Reactions; Phenomenology; Magnetic Monopoles and Dyons.

This work is a continuation of that currently supported by NSF Grant PHY75-01270 AO1.

SUPPORTED BY U.S. Natl. Science Foundation

8.0003, HIGH-ENERGY PRECISION K ZERO EXPERIMENTS
B.D. WINSTEIN, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637 (PHY76-80260)

This program is a collaborative one with a similar group from the University of Wisconsin and is being conducted at the Fermi National Accelerator Laboratory. The research involves the study of regeneration of Kaon particles by the interaction of K1 o mesons with matter. The program for this next year has three parts as follows: 1. Completion of analysis of Kaon regeneration on carbon and hydrogen targets. 2. Performance of an experiment on the regeneration of Kaon mesons by scattering of K1 o beams by electrons. 3. Study of the dependence of Kaon regeneration on the atomic weight A of the nucleus.

Information which will be obtained will have an important bearing upon questions such as the radius or size of the Kaon meson and the differences between Kaon and Kaon scattering cross sections at very high energies. Various theoretical models on the nature of those scatterings will also be tested.

This work represents a continuation of that currently supported by Foundation grant PHY71-03120 AO6, in which Professor V. Telegdi is principal investigator.

SUPPORTED BY U.S. Natl. Science Foundation

8.0004, NUMERICAL SIMULATION OF PLASMAS WITH SMOOTHING IN PHASE SPACE AND FILTERING IN TIME
J. DENAVIT, Northwestern University, Technological Institute, *Evanston, Illinois* 60201 (EY-76-S-02-2200)

The proposed research relates to (A) Numerical solutions of the collisional drift-kinetic equation in toroidal plasmas. Computations are based on expansions of the distribution function in orthogonal functions, which yield numerically stable solutions in the collisional case, and on the quasi-neutrality condition to compute the internal electric field. Particular applications are directed toward dissipative instabilities in tokamaks. (B) Computer simulation of ion ring stability. The computational study of the stability of high-energy, high-current proton rings is continued, using a two-dimensional code in which the background plasma is treated as a fluid while beam ions are represented as perturbed ring-shaped particles. (C) Collisional effects on turbulent heating of electrons. A collisional particle code will be applied to study collisional effects on the coupling between low-density hot electrons and a dense cold plasma resulting from streaming instabilities.

RESULTS: (1) Computer simulations of Langmuir turbulence have been extended to low pump fields (eta approximately or equal to 0.1 to 0.2) and to two dimensions. Coherent rather than turbulent soliton structures are found in one dimension, while solitons are continuously created and annihilated by collapse and Landau damping in two dimensions. (2) Long-time-scale particle simulations have been extended to cyclotron waves; these methods allow the computation of resonant- particle interactions with time steps delta t much greater than omega to the minus 1 power and grid spacings delta z much greater than c/omega (omega: gyrofrequency; c: speed of light).

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - C.T.R.D.

8.0005, IMPURITY PROFILES IN ION-IMPLANTED SEMICONDUCTORS

B.G. STREETMAN, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DMR73-02359 A01)

Ion implantation is widely used in the fabrication of silicon devices, and this technique is beginning to be applied to dope compound semiconductors. This research is concerned with determining impurity profiles in ion-implanted semiconductors, such as boron and phosphorus in silicon, and zinc in gallium arsenide. Total impurity distributions will be determined primarily by glow discharge optical spectroscopy, and in selected cases compared with secondary ion mass spectroscopy and Auger analysis. In selected cases differential capacitance-voltage measurements on reverse biased p-n junctions and Schottky barriers will be used to obtain electrically active profiles. Some Hall effect and resistivity measurements will be performed in conjunction with anodic oxidation and stripping of the implanted layers to provide information regarding carrier concentration and mobility in the implanted region. Where possible, photoluminescence measurements will be performed on successive layers of the implanted region to study profiles of optically active impurities and defect centers in the implanted region.

The research will provide a basic understanding of radiation damage and annealing processes in ion-implanted semiconductors, as well as developing suitable implantation and annealing procedures required to obtain optimum impurity profiles. This basic knowledge should help improve fabrication techniques for devices such as varactors, solar cells, and devices related to optoelectronics and integrated optics.

This is a renewal of Grant DMR-7302359 (GH-40450).

SUPPORTED BY U.S. Natl. Science Foundation

8.0006, THEORY OF PLASMAS WITH LARGE SELF FIELDS

J.U. GUILLORY, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (PHY76-80906)

This project will continue theoretical research on the equilibrium and stability properties of magnetically-confined non-neutral plasmas which are characterized by intense self electric fields and (in high current configurations) intense self magnetic fields. The research will include studies of the stability and synchrotron emission properties of relativistic nonneutral E-layers in a parameter regime pertinent to the Maryland mirror and electron ring accelerator experiments, investigations of the Vlasov equilibrium and stability properties of thin relativistic electron rings, and investigations of the equilibrium and stability properties of relativistic beam-plasma systems in linear geometry in circumstances where charge and current neutralization are incomplete.

Previous support was provided by PHY74-12622 AO1.

SUPPORTED BY U.S. Natl. Science Foundation

8.0007, SOLID-STATE PHYSICS STUDIES WITH POSITRONS

S. BERKO, Brandeis University, Graduate School, *Waltham, Massachusetts* 02154 (DMR76-24376)

Solid-state physics research using positron annihilation techniques previously supported by NSF grant DMR73-02563 A03 will be continued. The research program consists of two projects: a) electronic momentum density measurements using a newly built 64 counter two-dimensional angular correlation apparatus, and b) slow positron interaction studies with solid surfaces. Under project a) the Fermi surfaces and the electronic band structure of disordered as well as of some ordered alloys, and the electronic momentum densities in ferromagnetic metals will be investigated. In the slow positron beam experiments (project b), an ultrahigh vacuum system will be built to allow the study of well- specified surfaces. The formation of positronium by slow positrons at metal surfaces, the physics of positron work-function and positron emission from solid surfaces, as well as slow positron scattering will be studied experimentally. The parameters of the electronic dipole barrier at metal surfaces will be determined from these experiments.

SUPPORTED BY U.S. Natl. Science Foundation

8.0008, QUANTUM LIQUIDS AND CRYSTALS, SUPERCONDUCTIVITY, CLASSICAL FLUIDS AND SOLID-STATE PHYSICS

V. AMBEGAOKAR, Cornell University, School of Arts & Sciences, *Ithaca, New York* 14853 (DMR74-23494 A03)

Research in theoretical solid-state science, previously supported under GH-36457, will be continued, including studies of: Theory of the new phases of liquid helium three, particularly boundary effects, hydrodynamics and the theory of nuclear magnetic resonance; and work on the superconducting transition in thin films. Crystallization studies in classical and quantum systems, with particular emphasis on long-range potentials in classical and quantum crystals, the helium film and free surface of liquid helium, exploratory simulations of fermion systems. Theory of the new phases of helium three, in particular the thermodynamics near the critical temperature in a magnetic field and theory of nuclear magnetic resonance, and theory of the liquid vapor coexistence curve in classical fluids. Disordered systems, in particular, liquid metals, amorphous semiconductors and metallic alloys in the liquid state, and electron structure in condensed matter, studies in photoemission and optical properties. Dilute magnetic alloys, theory of low-temperature transport properties in pure metals, and theory of rare-earth metals.

SUPPORTED BY U.S. Natl. Science Foundation

8.0009, LASER LIGHT SCATTERING STUDIES OF SOLIDS

H.Z. CUMMINS, City University of New York, School of Arts & Sciences, *New York, New York* 10031 (DMR74-12040 A03)

Research using the techniques of light scattering in solids which was previously supported by NSF grant DMR-7412040 AO1 will be continued. High-resolution spectroscopic measurement of the central peak in KN2PO4 will be performed in order to determine its linewidth and establish its origin. Additional measurements will be performed under applied hydrostatic pressure and electric field to explore the region thought to contain a tricritical point. Additional Raman scattering experiments will be performed on Cu2O to establish the symmetry breaking mechanisms responsible for observed enhancement of forbidden scattering at resonance with excited states of the yellow exciton. Experiments are also planned in strong magnetic fields. A new project will be initiated to explore resonant Brillouin scattering in CdS utilizing a computer- controlled multiphased interferometer.

SUPPORTED BY U.S. Natl. Science Foundation

8.0010, THE STRUCTURE OF SOLID SURFACES II

F.P. JONA, State University of New York, School of Arts & Sciences, *Stony Brook, New York* 11790 (DMR72-03294 A02)

Research on LEED surface crystallography, previously supported under DMR72-03294, by the Stony Brook group (in association with scientists at the IBM Research Center in Yorktown Heights) will be continued. This work has concentrated on four surfaces (Mo(001), Ti (0001), Fe (001) and Si(001)) and several of their reactions with gases and vapors. The results obtained so far indicate that many overlayer structures of the 1 x 1 type are markedly more complicated than those of the c(2 x 2) type solved and published in the open literature by several groups. An essential, probably determining, factor in solving this kind of problem is the (now unavailable) knowledge of the precise amount of adsorbate atoms present on the surface under study. In the next two years it is anticipated that several projects will be carried out. First and foremost is the project aimed at the quantitative calibration of Auger electron spectroscopy (AES) signals by two different methods. Second is the study of the possibility of coexistence of two or more crystalline phases on the same surface: representative candidates are the overlayers of oxygen on Mo(001) and of carbon monoxide on Mo(001). Research completed in the past year includes a structural analysis for the (0001) surface of titanium and for the unreconstructed surface of silicon.

This is the 2nd year of a 2-year continuing grant.

SUPPORTED BY U.S. Natl. Science Foundation

8.0011, THEORY OF PARAELECTRIC DEFECT-PHONON INTERACTIONS
B.G. DICK, Univ. of Utah, School of Science, *Salt Lake City, Utah* 84112 (DMR73-02516 A01)

Theoretical research on the properties of off-center defects in alkali halide crystals, previously supported under GH-40094, will be continued and extended. Emphasis will be on the interaction of the defects with vibrations of the host lattice. The specific areas of research to be pursued are: (a) Investigation of the effect on dressed tunneling of defect-phonon interactions quadratic in lattice displacements. The transition from one-phonon assisted tunneling to Arrhenius-type behavior is of particular interest. (b) Investigation of IR absorption and in-band resonant modes for off-center Ag ion defects in RbCl and RbBr. (c) Study of the role of tacit adiabatic approximations in the customary treatment of paraelectric defect systems.

SUPPORTED BY U.S. Natl. Science Foundation

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, OBSERVATION OF COMETS, ATMOSPHERIC EXTINCTION AND IMAGE INTENSIFIER RESEARCH
A.R. KASSANDER, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (NCA 5-19)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0002, CONSTRUCTION OF A RADIAL VELOCITY METER FOR DETERMINING PERCENTAGE OF BINARIES AMONG SOLAR-TYPE STARS
K.M. SERKOWSKI, Univ. of Arizona, Lunar & Planetary Laboratory, *Tucson, Arizona* 85721 (NSG 2205)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0003, THEORETICAL ASTROPHYSICS RESEARCH
P. GOLDREICH, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (AST76-24281)

Studies in a number of areas of astrophysical interest will be carried out. The atmospheres of white dwarf stars will be studied: (1) Convective stability of these atmospheres will be analyzed; (2) The effects of accretion of interstellar gas onto the convecting atmospheres will be studied in order to have models to compare with observational data. There will be a numerical investigation of radiative transfer in an expanding envelope around a red supergiant star. The mechanism by which tidal energy is dissipated in binary star systems will be studied. Dynamical calculations aimed at providing explanations for several features of Saturn's rings will be made. Further studies into the excitation of solar oscillations will be carried out.

SUPPORTED BY U.S. Natl. Science Foundation

10.0004, PREPARATION OF A SET OF SKY MAPS IN HARD X-RAYS FROM OSO-1 DATA
L.E. PETERSON, Univ. of California, Graduate School, *San Diego, California* 92037 (NSG 7294)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0005, INTERPLANETARY STUDIES
M. DRYER, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8DJ4 15 30)

PROJECT OBJECTIVE: To understand the transfer of mass energy, and momentum from the sun to the various obstacles in the solar system. Study of the steady and non-steady state of the interplanetary medium (including its interaction with planetary magnetospheres, ionospheres and comets) will hopefully lead to an improved understanding of the sun's effect on the earth's magnetosphere. This desired knowledge is a necessary 'input' to questions regarding solar effects upon the magnetosphere, ionosphere and possibly even global weather patterns following solar flares or passage past the earth of inhomogeneous solar wind structure.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

10.0006, STUDY OF THE SOLAR CORONA USING RADIO OBSERVATION
G.A. DULK, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (NSG 7287)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0007, RESEARCH IN SOLAR PHYSICS WITH EMPHASIS ON EMPIRICAL NON-EQUILIBRIUM THERMODYNAMICS
R.N. THOMAS, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (NSG 7291)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0008, ELECTRON MICROPROBE STUDY OF LUNAR AND PLANETARY ZONED PLAGIOCLASE FELDSPARS
R.K. SMITH, Univ. of Southern Colorado, Graduate School, *Pueblo, Colorado* 81001 (NSG 9051)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0009, RESEARCH STUDY OF EDGE ENHANCEMENT OF MULTISPECTRAL IMAGERY
M.T. PAO, Savannah State College, Undergraduate School, *Savannah, Georgia* 31400 (NSG 8048)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0010, APPLICATIONS OF ELECTRON MICROSCOPY IN MOLECULAR EXOBIOLOGY AND EXTRATERRESTRIAL RESEARCH
H.F. MORAN, Univ. of Chicago, School of Medicine, *Chicago, Illinois* 60637 (NSG 7303)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0011, THEORETICAL INVESTIGATIONS IN STELLAR DYNAMICS AND GALACTIC STRUCTURE
P.O. VANDERVOORT, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637 (AST75-23593 A01)

The theoretical and observational understanding of the structure of our own spiral galaxy is at a point where further analytical research will provide a real step forward. The radio observations and computer methods will guide their research. Numerical investigations have shown that an analytic theory reproduces all of the resonance phenomena exhibited by stellar orbits. The theory provides the integrals of the motion required for the investigation of the equilibrium of a thin stellar disk in the resonance regions of a spiral galaxy.

The research will include extensions and generalizations of the perturbation theory at the Lindblad resonances, reformulation of the theory for the corotation region of the spiral galaxy, studies of the non-linear, resonant response of stellar and gaseous disks to the prevailing gravitational fields in spiral galaxies, studies of the influence of external fields (e.g., of a central bar) on the equilibrium of the resonance regions, investigation of the non-

linear coupling of density waves in the resonance regions, and studies of the role of trapped stars in the resonance regions.

SUPPORTED BY U.S. Natl. Science Foundation

10.0012, X-RAY BALLOON OBSERVATIONS FROM THE NORTHERN AND SOUTHERN HEMISPHERES
W.H. LEWIN, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (AST76-06133)

High-energy X-ray observations of galactic and extragalactic objects (approximately 18-150 KeV) will be conducted at an unprecedented level of sensitivity. Objects down to a flux level ten times weaker than the weakest sources observed by the Uhuru satellite will be observed. For bright sources, the system will be 'photon-limited' in sensitivity to burst or flare-like changes in source intensities. Consequently, for the 3000 cm2 system changes on characteristic time scales 4 to 5 times shorter than has been previously possible in hard X- rays will be detected (or, equivalently, for a given characteristic time changes 4 to 5 times smaller will be detected).

Briefly, some of the observational objectives are: Compact extragalactic objects (such as Cen A, 3C 273, NGC 4151, 3C 390.3, and others); Virgo cluster (M87); Globular clusters (NGC 6624 and NGC 6441); X-ray pulsars (NP 0532 and PSR 0833-45), including measurements of variability in the light curves of NP 0532; unidentified high-galactic latitude sources; X-ray binaries during periods of eclipse edges; measurements of periodicities and variabilities of the light curves of known and unknown pulsating X-ray objects such as: 3U 0900-40, SMC X-1, Her X-1, and others down to a time resolution of 1 msec; measurements of variability (periodic and non-periodic) of several known bright hard X- ray sources (Cyg X-1, Gx 301-2, GX 1 plus 4, Cyg X minus 3) down to a time resolution of 1 msec.

SUPPORTED BY U.S. Natl. Science Foundation

10.0013, RADIATIVE FLUID DYNAMIC STUDIES OF THE SUN AND COMPACT H II REGIONS
R.F. STEIN, Michigan State University, Graduate School, *East Lansing, Michigan* 48824 (NSG 7293)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0014, ANALYSIS AND INTERPRETATION OF PIONEER 10 AND 11 DATA
W.R. WEBBER, Univ. of New Hampshire, School of Technology, *Durham, New Hampshire* 03824 (NAS 5-23803)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0015, A STUDY OF THE COSMIC-RAY MODULATION USING GROUND-BASED NEUTRON MONITORS AND SPACECRAFT COSMIC-RAY DETECTORS
W.R. WEBBER, Univ. of New Hampshire, School of Technology, *Durham, New Hampshire* 03824 (ATM74-08695 A02)

This grant continues the operation of the Mt. Washington neutron monitor through the current minimum in solar modulation, 1974-1977, to provide continuous coverage through two solar activity cycles. A comparison will be made of the residual modulation at the minima in solar activity that occurred in 1954, 1965 and 1973-76. Second, the phase-lag effect (or hysteresis effect) in the 11-year variation will be studied. This study, being carried out in collaboration with other members of the UNH cosmic-ray group, will use not only neutron monitor and satellite data but balloon flight data on electrons and other charge components of the cosmic radiation over energies ranging from approximately 10 MeV to 1000 MeV. Third, a detailed analysis of the radial gradient of cosmic rays using Pioneer and IMP satellite data and neutron monitor data will be made and the results from indirect methods will be re-examined to determine whether there is a cosmic-ray gradient transverse to the solar equatorial plane. Fourth, from the neutron monitor data and satellite cosmic-ray and magnetic field measurements, a quantitative physical model for Forbush decreases will be developed.

The overall objective will be a greater understanding of cosmic-ray modulation.

SUPPORTED BY U.S. Natl. Science Foundation

10.0016, PHYSICAL STUDY OF COMETS
A.H. DELSEMME, Univ. of Toledo, School of Arts & Sciences, *Toledo, Ohio* 43606 (NSG 7301)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0017, MOLECULAR VIBRATIONS, MAINLY IN CRYSTALS
J.C. DECIUS, Oregon State University, School of Science, *Corvallis, Oregon* 97331 (CHE74-02217 A02)

Observational and theoretical studies will be made on supernova remnants in order to develop a better understanding of their structure. In particular, studies will be made of the origin of the magnetic fields, the nature of the plasma processes in the remnants, and the causes of shell gaps and asymmetries. The National Radio Astronomy Observatory 140-foot telescope will be used for observations as well as the radio-heliograph at Culgoora, Australia, and the radio telescope at Arecibo, Puerto Rico.

SUPPORTED BY U.S. Natl. Science Foundation

10.0018, STUDY OF INTERPLANETARY DUST
UNKNOWN, Univ. of Washington, Graduate School, *Seattle, Washington* 98105 (NSG 9052)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0019, STUDIES OF EXTENDED AND EXPANDING STELLAR ATMOSPHERES
J.P. CASSINELLI, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (AST76-15448)

The structure of the atmospheres of hot stars which show spectral evidence of geometrical extension, expansion and rotational distortion will be studied. The investigation will be composed of three related parts: (1) A theory of the star's corona and of a wind driven by radiation pressure will be developed in order to explain the observed rise in temperature in the outer layers of hot stars. (2) An analysis of the continuous energy distribution in the atmosphere will be made in order to determine the structure of the atmosphere. (3) There will be a further development of rotationally distorted stellar atmospheres in order to study methods for probing the density structure of early-type stellar atmospheres.

SUPPORTED BY U.S. Natl. Science Foundation

GENERAL

11.0001, THE INTEGRATION OF THEORY AND EXPERIMENT
D.M. VESTAL, Auburn University, School of Engineering, *Auburn, Alabama* 36830 (NCA 2-48701)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11.0002, PARTICIPATION IN THE SCIENCE PLANNING FOR THE VIKING 1975 MISSIONS IN THE AREA OF METEOROLOGY
J.A. RYAN, Calif. State Univ. & Colleges, Graduate School, *Fullerton, California* 92631 (NAS 1-14621)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11.0003, OPERATION OF THE TECHNOLOGY USE CENTER
C.H. GOLD, Southeastern State College, Graduate School, *Durant, Oklahoma* 74701 (NASW 3007)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11.0004, SYMPOSIUM ON AERONAUTICS AND SPACE AIMED AT MOTIVATING MINORITIES AND WOMEN IN SCIENCE AND ENGINEERING
B. BOWMAN, Oregon State University, Graduate School, *Corvallis, Oregon* 97331 (NASW 3012)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11.0005, SUMMER RESEARCH FELLOWSHIP PROGRAM
G.C. DARDEN, Hampton Institute, Graduate School, *Hampton, Virginia* 23368 (NAS 1-14832)

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N77-21020*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MEASURES OF PILOT PERFORMANCE DURING V/TOL AIRCRAFT LANDINGS ON SHIPS AT SEA
James C. Howard Feb. 1977 23 p refs
(NASA-TM-X-73212; A-6942) Avail: NTIS HC A02/MF A01 CSCL 05E

Simulation experiments to determine the feasibility of landing V/TOL aircraft on ships at sea were studied. The motion and attitude of the aircraft relative to the landing platform was known at the instant of touchdown. The success of these experiments depended on the ability of the experimenter to measure the pilot's performance during the landing maneuver. To facilitate these measurements, the equations describing the motion of the aircraft and its attitude relative to the landing platform are presented in a form which is suitable for simulation purposes.
Author

N77-21021# Saad Publications, Karachi (Pakistan).
AEROSPACE SYSTEMS (EARLY CONCEPTS)
A. N. Ponomarev and V. S. Mikhailov 1976 11 p Transl. into ENGLISH from IAF, 1975 p 1-8 Sponsored by NSF and Smithsonian Inst.
(TT-76-53472) Avail: NTIS HC A02/MF A01

The evolution of concepts in aviation and astronautics, as a result of which the modern opinions have become formulated regarding the aerospace systems are reviewed. The ideas, suggested at the initial stage, regarding the theoretical foundations of astronautics, i.e. in the first third of the twentieth century are stipulated.
Author

N77-21022*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLUTTER TESTING TECHNIQUES
1976 483 p Conf. Proc. held at Dryden Flight Res. Center in Edwards, Calif., 9-10 Oct. 1975
(NASA-SP-415) Avail: NTIS HC A21/MF A01 CSCL 01C

Developments in methodology and data analysis techniques for flutter testing in flight and on the ground are discussed. For individual titles, see N77-21023 through N77-21041.

N77-21023*# Aeronautical Research Associates of Princeton, Inc., N. J.
ON IDENTIFYING FREQUENCIES AND DAMPING IN SUBCRITICAL FLUTTER TESTING **c08**
John C. Houbolt *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 1-42 (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

Various procedures that might be used in evaluating system response characteristics as involved in subcritical flight and wind-tunnel flutter testing of aircraft are reviewed with emphasis on the means for eliminating or minimizing the contamination effects produced by an unknown noise in the input. Results of a procedure developed for identifying modal frequency and damping values, and a possible way for making a detailed evaluation of system parameters, are also given.
Author

N77-21024*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CURVE FITTING OF AEROELASTIC TRANSIENT RESPONSE DATA WITH EXPONENTIAL FUNCTIONS **c02**
Robert M. Bennett and Robert N. Desmarais *In its* Flutter Testing Tech., 1976 p 43-58 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01A

The extraction of frequency, damping, amplitude, and phase information from unforced transient response data is considered. These quantities are obtained from the parameters determined by fitting the digitized time-history data in a least-squares sense with complex exponential functions. The highlights of the method are described, and the results of several test cases are presented. The effects of noise are considered both by using analytical examples with random noise and by estimating the standard deviation of the parameters from maximum-likelihood theory.
Author

N77-21025*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DETERMINATION OF SUBCRITICAL DAMPING BY MOVING-BLOCK/RANDOMDEC APPLICATIONS **c05**
Charles E. Hammond (Army Air Mobility R&D Lab., Langley, Va.) and Robert V. Doggett, Jr. *In* Its Flutter Testing Tech., 1976 p 59-76 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

Two techniques are described which allow the determination of subcritical dampings and frequencies during aeroelastic testing of flight vehicles. The moving-block technique is shown to have the advantage of being able to provide damping and frequency information for each mode which might be present in a signal trace, but it has the disadvantage of requiring that the structure be excited transiently. The randomdec technique requires only random turbulence for excitation, but the randomdec signature is difficult to analyze when more than one mode is present. It is shown that by using the moving-block technique to analyze the randomdec signatures, the best features of both methods are gained. Examples are presented illustrating the direct application of the moving-block method to model helicopter rotor testing and application of the combined moving-block/randomdec method to flutter studies of two fixed-wing models.
Author

N77-21026*# Boeing Commercial Airplane Co., Seattle, Wash.
TRANSIENT EXCITATION AND DATA PROCESSING TECHNIQUES EMPLOYING THE FAST FOURIER TRANSFORM FOR AEROELASTIC TESTING **c05**
W. P. Jennings, N. L. Olsen, and M. J. Walter *In* NASA. Langley Res. Center Flutter Testing Tech., 1976 p 77-114 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

The development of testing techniques useful in airplane

ground resonance testing, wind tunnel aeroelastic model testing, and airplane flight flutter testing is presented. Included is the consideration of impulsive excitation, steady-state sinusoidal excitation, and random and pseudorandom excitation. Reasons for the selection of fast sine sweeps for transient excitation are given. The use of the fast fourier transform dynamic analyzer (HP-5451B) is presented, together with a curve fitting data process in the Laplace domain to experimentally evaluate values of generalized mass, model frequencies, dampings, and mode shapes. The effects of poor signal to noise ratios due to turbulence creating data variance are discussed. Data manipulation techniques used to overcome variance problems are also included. The experience is described that was gained by using these techniques since the early stages of the SST program. Data measured during 747 flight flutter tests, and SST, YC-14, and 727 empennage flutter model tests are included. Author

N77-21027*# Lockheed-California Co., Burbank.
TURBULENCE EXCITED FREQUENCY DOMAIN DAMPING MEASUREMENT AND TRUNCATION EFFECTS **c05**
Jaak Soovere *In* NASA. Langley Res. Center Flutter Testing Tech., 1976 p 115-142 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

Existing frequency domain modal frequency and damping analysis methods are discussed. The effects of truncation in the Laplace and Fourier transform data analysis methods are described. Methods for eliminating truncation errors from measured damping are presented. Implications of truncation effects in fast Fourier transform analysis are discussed. Limited comparison with test data is presented. Author

N77-21028*# Systems Control, Inc., Cambridge, Mass.
SPECIFICATION OF INPUTS AND INSTRUMENTATION FOR FLUTTER TESTING OF MULTIVARIABLE SYSTEMS **c05**
Narendra K. Gupta and W. Earl Hall, Jr. *In* NASA. Langley Res. Center Flutter Testing Tech., 1976 p 143-180 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

The application of system identification methods in flutter testing of aeroelastic structure is discussed. The accuracy with which flutter parameters are estimated depends upon the test plan and on the algorithms used to reduce the data. The techniques for selecting the kinds and optimal positions of inputs and instrumentation, under typical test constraints, are presented. Identification results for both the input/output transfer function and the value of physical parameters are given. Numerical results on the optimal input spectrum and the accelerometer location for estimating flutter parameters of a two dimensional wing are obtained using these algorithms. Current work on applying system identification methods to high order three dimensional aeroelastic structures is reported. Author

N77-21029*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME EXPERIENCE USING SUBCRITICAL RESPONSE METHODS IN WIND-TUNNEL FLUTTER MODEL STUDIES **c05**
Jerome T. Foughner, Jr. *In its* Flutter Testing Tech., 1976 p 181-192 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01A

Experiences obtained with four methods of predicting flutter of wind-tunnel models from subcritical response data are described. The four methods are: co/quad, randomdec, power spectra density, and the peak-hold spectrum. Model excitation techniques included both forced (sinusoidal sweep) and random (tunnel turbulence). These methods were successfully used to measure the frequency and damping (or an inverse response amplitude proportional to the damping) in the predominant flutter modes. Implementation and application of each method are discussed. Some results and comparisons between methods are presented. Author

N77-21030*# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
WIND TUNNEL INVESTIGATION OF SUPERSONIC WING-TAIL FLUTTER **c05**
Lawrence J. Huttsell, Thomas E. Noll, and Donald E. Holsapple *In* NASA. Langley Res. Center Flutter Testing Tech., 1976 p 193-212 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

A flutter model, consisting of a wing, horizontal tail, and splitter plate/fuselage mechanism, was tested in a 4-foot transonic tunnel in the Mach number range 1.1 to 1.3. Two types of flutter were encountered during the testing: a wing-tail flutter bending-torsion flutter mode. The wing-tail flutter speed was found to be a minimum at M = 1.2 for the configuration tested. Recorded model test data were digitized for a power spectral density (PSD) analysis and Random Decrement (Randomdec) analysis. Comparisons between the frequency and damping obtained from the PSD plots and the Randomdec signatures agreed very well. A limited flutter analysis was conducted using a Mach box unsteady aerodynamics method which accounted for interference and airfoil thickness. Analytical comparisons with experimental flutter speeds agreed well. The analyses assuming zero thickness predicted flutter speeds higher than those measured, ranging from 1 percent at M = 1.12 to 8 percent at M = 1.28. With the airfoil thickness included, the correlation was improved such that predicted flutter speeds for all cases investigated were within 2 percent of experimental speeds. Author

N77-21031*# General Dynamics Corp., San Diego, Calif.
THE DESIGN, ANALYSIS, AND TESTING OF A LOW-BUDGET WIND-TUNNEL FLUTTER MODEL WITH ACTIVE AERODYNAMIC CONTROLS **c02**
R. Bolding and R. Stearman (Texas Univ., Austin) *In* NASA. Langley Res. Center Flutter Testing Tech., 1976 p 213-242 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01A

A low budget flutter model incorporating active aerodynamic controls for flutter suppression studies was designed as both an educational and research tool to study the interfering lifting surface flutter phenomenon in the form of a swept wing-tail configuration. A flutter suppression mechanism was demonstrated on a simple semirigid three-degree-of-freedom flutter model of this configuration employing an active stabilator control, and was then verified analytically using a doublet lattice lifting surface code and the model's measured mass, mode shapes, and frequencies in a flutter analysis. Preliminary studies were significantly encouraging to extend the analysis to the larger degree of freedom AFFDL wing-tail flutter model where additional analytical flutter suppression studies indicated significant gains in flutter margins could be achieved. The analytical and experimental design of a flutter suppression system for the AFFDL model is presented along with the results of a preliminary passive flutter test. Author

N77-21032*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CORRELATION WITH FLIGHT OF SOME AEROELASTIC MODEL STUDIES IN THE NASA LANGLEY TRANSONIC DYNAMICS TUNNEL **c02**
Wilmer H. Reed, III *In* Its Flutter Testing Tech., 1976 p 243-262 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01A

The NASA Langley transonic dynamics tunnel, which has a variable density Freon-12 (or air) test medium, was designed specifically for the study of dynamics and aeroelastic problems of aerospace vehicles. During the 15 years of operation of this facility, there have been various opportunities to compare wind tunnel and flight test results. Some of these opportunities arise from routine flight checks of the prototypes; others, from carefully designed comparative wind-tunnel and flight experiments. Such data obtained from various published and unpublished sources are presented. The topics covered are: gust and buffet response, control surface effectiveness, flutter, and active control of aeroelastic effects. Some benefits and shortcomings of Freon-12 as a test medium are also discussed. Although areas of uncertainty are evident and there is a continuing need for improvements in model simulation and testing techniques, the results presented indicate that predictions from aeroelastic model tests are, in general, substantiated by full scale flight tests. Author

N77-21033*# Air Force Flight Test Center, Edwards AFB, Calif.
TIME SERIES ANALYSIS IN FLIGHT FLUTTER TESTING AT THE AIR FORCE FLIGHT TEST CENTER: CONCEPTS AND RESULTS **c05**
Russell W. Lenz and Bruce McKeever (TIME/DATA Corp.) *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 287-318 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

The Air Force Flight Test Center (AFFTC) flight flutter facility is described. Concepts of using a minicomputer-based time series analyzer and a modal analysis software package for flight flutter testing are examined. The results of several evaluations of the software package are given. The reasons for employing a minimum phase concept in analyzing response only signals are discussed. The use of a Laplace algorithm is shown to be effective for the modal analysis of time histories in flutter testing. Sample results from models and flight tests are provided. The limitations inherent in time series analysis methods are discussed, and the need for effective noise reduction techniques is noted. The use of digital time series analysis techniques in flutter testing is shown to be fast, accurate, and cost effective. Author

N77-21034*# Grumman Data Systems Corp., Bethpage, N.Y.
FLIGHT FLUTTER TESTING TECHNOLOGY AT GRUMMAN **c05**
H. J. Perangelo and F. W. Milordi (Grumman Aerospace Corp.) *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 319-376 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

Analysis techniques used in the automated telemetry station (ATS) for on line data reduction are encompassed in a broad range of software programs. Concepts that form the basis for the algorithms used are mathematically described. The control the user has in interfacing with various on line programs is discussed. The various programs are applied to an analysis of flight data which includes unimodal and bimodal response signals excited via a swept frequency shaker and/or random aerodynamic forces. A nonlinear response error modeling analysis approach is described. Preliminary results in the analysis of a hard spring nonlinear resonant system are also included. Author

N77-21035*# Lockheed-California Co., Burbank.
THE APPLICATION OF DIGITAL COMPUTERS TO NEAR-REAL-TIME PROCESSING OF FLUTTER TEST DATA **c60**
S. R. Hurley *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 377-394 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 09B

Procedures used in monitoring, analyzing, and displaying flight and ground flutter test data are presented. These procedures include three digital computer programs developed to process structural response data in near real time. Qualitative and quantitative modal stability data are derived from time history response data resulting from rapid sinusoidal frequency sweep forcing functions, tuned-mode quick stops, and pilot induced control pulses. The techniques have been applied to both fixed and rotary wing aircraft, during flight, whirl tower rotor systems tests, and wind tunnel flutter model tests. An hydraulically driven oscillatory aerodynamic vane excitation system utilized during the flight flutter test programs accomplished during Lockheed L-1011 and S-3A development is described. Author

N77-21036*# Gates Learjet Corp., Denver, Colo.
THE APPLICATION OF RECENT TECHNIQUES IN FLIGHT FLUTTER TESTING **c05**
M. A. Abla *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 395-412 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

The relative merits of sinusoidal excitation versus random atmospheric turbulence was investigated. The randomdec and autocorrelation methods were used to analyze data from a Learjet flight test. A parameter identification digital program, using least squares approach, was developed to determine the aeroelastic characteristics of a two mode system. The flight test program, computer program, and data reduction procedure is presented. Final results of the two modes of excitation obtained by Randomdec method are discussed. Author

N77-21037*# Lockheed Aircraft Corp., Burbank, Calif.
F-15 FLIGHT FLUTTER TEST PROGRAM **c05**
Henry Katz, G. Francis Foppe, and Daniel T. Grossman *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 413-432 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01G

The modes to be observed during the F-15 flight flutter test program were selected on the basis of the results of analytical studies, wind tunnel tests, and ground vibration tests. The modes (both symmetrical and antisymmetrical) tracked on this basis were: fin first bending, fin torsion, fin tip roll, stabilator bending, stabilator pitch, boom lateral bending, boom torsion, boom vertical bending, wing first bending, wing second bending, wing first torsion, outer wing torsion, and aileron rotation. Data obtained for these various modes were evaluated in terms of damping versus airspeed at 1525 m (5000 ft), damping versus altitude at the cross-section Mach numbers (to extrapolate to the damping value to be expected at sea level), and flutter boundaries on the basis of flutter margin of various modal pairs representing potential flutter mechanisms. Results of these evaluations are summarized in terms of minimum predicted flutter margin for the various mechanisms. Author

N77-21038*# General Dynamics/Fort Worth, Tex.
YF-16 FLIGHT FLUTTER TEST PROCEDURES **c05**
Warren J. Brignac, Halvor B. Ness, Maynard K. Johnson, and Larz M. Smith *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 433-456 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

The Random Decrement technique (Randomdec) was incorporated in procedures for flight testing of the YF-16 lightweight fighter prototype. Damping values obtained substantiate the adequacy of the flutter margin of safety. To confirm the structural modes which were being excited, a spectral analysis of each channel was performed using the AFFTC time/data 1923/50 time series analyzer. Inflight test procedure included the careful monitoring of strip charts, three axis pulses, rolls, and pullups. Author

N77-21039*# Sikorsky Aircraft, Stratford, Conn.
INFLIGHT ROTOR STABILITY MONITOR **c06**
William A. Kuczynski *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 457-472 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01D

An inflight rotor stability monitor developed at Sikorsky Aircraft to support stability testing of new rotorcraft is described. The monitor has as its core a damping estimation algorithm which embodies spectral analysis techniques. The interactive system is activated and controlled from a cathode ray tube (CRT) and operates on-line in a flight test telemetry environment. Accurate estimates of the level of damping of critical system modes are generated within one minute of the completion of a prescribed test maneuver. The stability monitor was used successfully to support various Sikorsky research and development flight programs including the UTTAS, CH-53E, S-67 Fan-in-Fin, and ABC.
Author

N77-21040*# Boeing Vertol Co., Philadelphia, Pa.
INVESTIGATION OF AEROELASTIC STABILITY PHENOMENA OF A HELICOPTER BY IN-FLIGHT SHAKE TEST **c08**
Wen-Liu Miao, Thomas Edwards, and David E. Brandt *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 473-500 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

The analytical capability of the helicopter stability program is discussed. The parameters which are found to be critical to the air resonance characteristics of the soft in-plane hingeless rotor systems are detailed. A summary of two model test programs, a 1/13.8 Froude-scaled BO-105 model and a 1.67 meter (5.5 foot) diameter Froude-scaled YUH-61A model, are presented with emphasis on the selection of the final parameters which were incorporated in the full scale YUH-61A helicopter. Model test data for this configuration are shown. The actual test results of the YUH-61A air resonance in-flight shake test stability are presented. Included are a concise description of the test setup, which employs the Grumman

Automated Telemetry System (ATS), the test technique for recording in-flight stability, and the test procedure used to demonstrate favorable stability characteristics with no in-plane damping augmentation (lag damper removed). The data illustrating the stability trend of air resonance with forward speed and the stability trend of ground resonance for percent airborne are presented. Author

N77-21041*# Bell Helicopter Co., Fort Worth, Tex.
FLIGHT FLUTTER TESTING OF ROTARY WING AIRCRAFT USING A CONTROL SYSTEM OSCILLATION TECHNIQUE **c05**
Jing G. Yen, Sathy Viswanathan, and Carl G. Matthys *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 501-512 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

A flight flutter testing technique is described in which the rotor controls are oscillated by series actuators to excite the rotor and airframe modes of interest, which are then allowed to decay. The moving block technique is then used to determine the damped frequency and damping variation with rotor speed. The method proved useful for tracking the stability of relatively well damped modes. The results of recently completed flight tests of an experimental soft-in-plane rotor are used to illustrate the technique. Included is a discussion of the application of this technique to investigation of the propeller whirl flutter stability characteristics of the NASA/Army XV-15 VTOL tilt rotor research aircraft. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N77-21042 Engineering Sciences Data Unit, London (England).
LIFT-INTERFERENCE AND BLOCKAGE CORRECTIONS FOR TWO-DIMENSIONAL SUBSONIC FLOW IN VENTILATED AND CLOSED WIND-TUNNELS Data Item
Nov. 1976 30 p
(ESDU-76028; ISBN-0-85679-165-2) For information on availability of series, sub-series, or individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. (write for prices)

Data are given for the conversion of wind tunnel measurements to corresponding free air data. ESDU

N77-21043 Engineering Sciences Data Unit, London (England).
SUBSONIC BASE DRAG OF CYLINDRICAL BODIES WITH CONICAL BOAT-TAILS Data Item
Nov. 1976 5 p
(ESDU-76033; ISBN-0-85679-170-9) For information on availability of series, sub-series, or individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. (write for prices)

A means of estimating the jet-off base drag coefficient, at Mach numbers up to 0.8, of cylindrical bodies with conical boat-tailing, and with turbulent boundary layers over the body is described. The method is purely empirical and is based on a method developed at the British Aircraft Corporation (Guided Weapons) LtD, Filton. The data used in deriving the method were mostly obtained from wind tunnel investigations, but a few tests were conducted on free-flight models with cylindrical bases (i.e. no boat-tailing). ESDU

N77-21044# Toronto Univ. (Ontario).
AERODYNAMIC INTERFERENCE OF HIGH SPEED GROUND VEHICLES
G. W. Johnston, B. V. Seshagiri, and N. D. Ellis Jun. 1976 58 p refs Sponsored by the Ontario Ministry of Transportation
(UTIAS-185; CN-ISSN-0082-5255) Avail: NTIS HC A04/MF A01

A two-dimensional, incompressible, potential flow solution based on A.M.O. Smith's method was developed capable of predicting the unsteady interference pressure loadings on either moving or stationary bodies of arbitrary shape due to the passage of a second body. The pressure distribution was suitably integrated to yield overall forces (side and axial) and moments (rolling and yawing). Effects of crosswinds of arbitrary magnitude and direction are accurately included. The results of a wide range of computations using different body configurations are presented and analysed. Author

N77-21045# Aeronautical Research Labs., Melbourne (Australia).
AN INVESTIGATION OF SUPERCRITICAL AEROFOIL BGK-1. PART 1: NEAR DESIGN POINT TESTS AND COMPARISONS WITH THEORY
W. Pollock and B. D. Fairlie Nov. 1975 70 p refs
(ARL/Aero-Rep-144-Pt-1) Avail: NTIS HC A04/MF A01

Comparisons between theoretical calculations using Garabedian and Korn's method of analysis and experimentally measured surface pressure distributions show good agreement. The surface pressure distributions, together with shadowgraph and schlieren photographs confirm the shock free nature of the flow and provide further verification of the method of design, as well as illustrating the development of the flow at conditions removed from the design conditions. Author

N77-21046# Aeronautical Research Labs., Melbourne (Australia).
AN INVESTIGATION OF SUPERCRITICAL AEROFOIL BGK-1. PART 3: EXTENDED SUBSONIC AND TRANSONIC TESTS
B. D. Fairlie and N. Pollock Nov. 1975 36 p refs Document includes a Microfiche supplement
(ARL/Aero-Rept-146-Pt-3) Avail: NTIS HC A03/MF A01

Transonic wind tunnel tests on the supercritical lifting aerofoil BGK-1 are reported. Surface pressure distributions and wake traverse measurements are included for two geometrically similar models of this aerofoil. The tests cover a range of Mach number of 0.5 less than or equal to M less than or equal to 0.8, and angles of incidence from below zero lift up to and including the onset of stall. All tests were conducted with transition fixed on both surfaces, and at the maximum available Reynolds numbers. Integrated force coefficient results indicate a section with a gentle onset of stall and a generally constant nose down pitching moment. Drag rise boundaries occur at significantly higher Mach numbers than for conventional sections at similar normal force coefficients. The drag rise boundaries and pitching moment coefficients for both models are in fair agreements, but the results generally show significant differences in normal force coefficients. The tests indicate that these differences are almost entirely due to the effects of wind tunnel wall interference, and not to differences in test Reynolds numbers. No corrections for interference were applied to the results presented. Author

N77-21047*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL RESULTS OF THE AERODYNAMIC CHARACTERISTICS OF A 1/8-SCALE MODEL OF A TWIN ENGINE SHORT-HAUL TRANSPORT
John W. Paulson, Jr. Apr. 1977 228 p refs
(NASA-TM-X-74011) Avail: NTIS HC A11/MF A01 CSCL 01A

A wind tunnel test was conducted in the Langley V/STOL tunnel to define the aerodynamic characteristics of a 1/8-scale twin-engine short haul transport. The model was tested in both the cruise and approach configurations with various control surfaces deflected. Data were obtained out of ground effect for the cruise configuration and both in and out of ground effect for the approach configuration. These data are intended to be a reference point to begin the analysis of the flight characteristics of the NASA terminal configured vehicle (TCV) and are presented without analysis. Author

N77-21048*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.
AN ANALYTICAL MODEL FOR PREDICTING THE AERODYNAMIC PERFORMANCE OF A TURBINE CASCADE WITH FILM COOLING
Eric R. McFarland and W. Tabakoff Mar. 1977 101 p refs (Grant NGR-36-004-064)
(NASA-CR-135175) Avail: NTIS HC A06/MF A01 CSCL 21E

Various analytical approaches to predicting the performance of film cooled turbine blades are reviewed. A two-dimensional cascade flow solution is developed for calculating the effects of the coolant injection on the total flow field. This solution is used with an available analytical performance predicting method to provide an improved method. Comparisons are made. with experimental data and other analytical results. Author

N77-21049*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF INTERNAL FLOW OF J85-13 MULTISTAGE COMPRESSOR
Roy D. Hager Apr. 1977 20 p refs
(NASA-TM-X-3513; E-8493) Avail: NTIS HC A02/MF A01 CSCL 01A

Interstage data recorded on a J85-13 engine were used to analyze the internal flow of the compressor. Measured pressures and temperatures were used as input to a streamline analysis program to calculate the velocity diagrams at the inlet and outlet of each blade row. From the velocity diagrams and blade geometry, selected blade-element performance parameters were calculated. From the detailed analysis it is concluded that the compressor is probably hub critical (stall initiates at the hub) in the latter stages for the design speed conditions. As a result, the casing treatment over the blade tips has little or no effect on stall margin at design speed. Radial inlet distortion did not appear to change the flow in the stages that control stall because of the rapid attenuation of the distortion within the compressor. Author

N77-21050*# Boeing Commercial Airplane Co., Seattle, Wash.
INVESTIGATION OF REFRACTING FLOWS FOR ACOUSTIC SUPPRESSION Final Report
Denis Sloan, Robert B. Purves, and Bannister W. Farquhar Washington NASA Apr. 1977 84 p refs
(Contract NAS1-14187)
(NASA-CR-2816; D6-44217) Avail: NTIS HC A05/MF A01 CSCL 01C

An experimental investigation to determine the possibility of using refracting flows for the suppression of aircraft inlet noise is described. Observations of wave refraction in duct flows and measurements of the increase in effectiveness of acoustic linings due to refraction have suggested methods for the design of engine inlet ducts which can either suppress noise internally or direct it to where it causes less annoyance. Author

N77-21051*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACOUSTIC AND AERODYNAMIC PERFORMANCE OF A 1.5-PRESSURE-RATIO, 1.83-METER (6 FT) DIAMETER FAN STAGE FOR TURBOFAN ENGINES (QF-2)
Richard P. Woodward, James G. Lucas, and Joseph R. Balombin Washington Apr. 1977 57 p refs
(NASA-TM-X-3521; E-8968) Avail: NTIS HC A04/MF A01 CSCL 21E

The fan was externally driven by an electric motor. Design features for low-noise generation included the elimination of inlet guide vanes, long axial spacing between the rotor and stator blade rows, and the selection of blade-vane numbers to achieve duct-mode cutoff. The fan QF-2 results were compared with those of another full-scale fan having essentially identical aerodynamic design except for nozzle geometry and the direction of rotation. The fan QF-2 aerodynamic results were also compared with those obtained from a 50.8 cm rotor-tip-diameter model of the reverse rotation fan QF-2 design. Differences in nozzle geometry other than exit area significantly affected the comparison of the results of the full-scale fans. Author

N77-21052# Bristol Univ. (England). Dept. of Aeronautical Engineering.
FLOWS AROUND CONTAINER SHAPES Ph.D. Thesis
R. N. Benke and A. D. Gower-Jones Jun. 1976 47 p refs
(BU-204) Avail: NTIS HC A03/MF A01

A qualitative description of the flow past statically constrained models of 20 ft x 8 ft x 8 ft cuboid containers is presented, the positions of the models in the airflow being chosen to simulate likely orientations of such containers when carried beneath helicopters in flight. The results of tests using a series of flow visualization techniques were recorded photographically and a study of these, in addition to visual observations, was undertaken to obtain details of the flow patterns. The flow over the models is dominated by the effects of sharp edges, which cause boundary layer separation. Separated fluid layers from adjacent sides interact extensively and this gives rise to dominant and complex three-dimensional variations from a comparable flow over a two-dimensional rectangular cylinder. As the attitude of a model is varied, features in the flow grow and decay to accommodate the bluff shape. Evidence of bi-stability in the flow symmetry can be detected. Drawings and a selection of photographs are presented to illustrate the description; a brief appendix containing details of the photographic lighting used is included. Author (ESA)

N77-21053# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
EXPERIMENTAL INVESTIGATION OF THE NEAR WAKE OF CIRCULAR RODS BY MEASUREMENT OF THE TEMPERATURE FLUCTUATIONS
Wolfgang J. Wagner 1976 87 p refs In GERMAN; ENGLISH summary
(MPIS-Mitt-62) Avail: NTIS HC A05/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger., DM 23

The natural temperature fluctuations in the near wake of a circular rod (diameter = 3 cm, Re = 4.7 x 10,000) were investigated quantitatively. The measurements were performed with a new highly sensitive temperature measuring probe having a fast response. Simultaneous measurements of temperature and velocity fluctuations indicated that, in regions with vortex-like velocity fields, the temperature is raised. The interpretation of the characteristic temperature signals occurring in the formation region contributed, in some essential points, to a better understanding of the flow phenomena in that region. Additional measurements were performed downstream of the formation region with two temperature measuring probes. The processing of the signals by conditional sampling and correlation measuring techniques led to findings concerning the path directions and the distribution of the discrete vortices. The interaction between the undisturbed flow (in the neighborhood of the rod) and the wake was also studied. This was accomplished by marking the flow in the undisturbed region beside the rod with heat (by means of an artificial heat source) and measuring the temperature fluctuations with the abovementioned probe. Author (ESA)

N77-21054# Centre National d'Etudes Spatiales, Toulouse (France).
BALLOON LAUNCHING. EXPERIMENTER'S GUIDE
1976 61 p
Avail: NTIS HC A04/MF A01

General information is provided on CNES balloon flights, covering the types of balloon flights currently being carried out by CNES, projects at the development stage, and the various stages of free flight for stratospheric and tropospheric balloons. Basic practical information is also given for launching a free stratospheric balloon experiment from France. ESA

N77-21055# Institut Franco-Allemand de Recherches, St. Louis (France).
HEAD WAVE FORMATION ON BLUNT BODIES IN THE FLOW BEHIND A PROPAGATING SHOCK WAVE Ph.D. Thesis - Karlsruhe Univ., West Ger. [AUSBILDUNG DER KOPFWELLE STUMPFER KOERPER IN DER STROEMUNG HINTER DEM LAUFENDEN STOSS]
Gunther Patz 12 Mar. 1976 88 p refs In GERMAN
(ISL-R-107/76) Avail: NTIS HC A05/MF A01

The formation of head waves as investigated for blunt bodies in a propagating shock followed by a supersonic flow. The shock wave incidence results in an unsteady flow with a head wave propagating upstream during the first period. After a certain development time, the head wave remains at a given distance, the flow having become steady. Several blunt bodies were investigated in a shock tube at several shock velocities using shadowgraph photography. Complementary density measurements were carried out with a differential laser interferometer. ESA

N77-21056# Karlsruhe Univ. (West Germany). Inst. fuer Stroemungslehre und Stroemungsmaschinen.

CALCULATION OF FLOW FIELDS WITH SEPARATION BUBBLES AT LARGE REYNOLDS NUMBERS

Dieter Geropp and Joachim Grashof Cologne DFVLR 27 Sep. 1976 50 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-378)

(DLR-FB-76-52) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, DM 25,30

The two-dimensional, steady, incompressible flow around a body is divided into five zones and is idealized: external flow - potential flow; attached flow - boundary layer; dead-air flow - fictive body causing a typical pressure distribution; flow between the bubble and the dead-air - boundary layer; separation bubble - fictive thickening on the body causing a typical pressure distribution. The influence of the dead-air, the bubble, and the boundary layer on the external flow are simulated by a fictive body, its shape being calculated in analogy to the method of Grashof (1973). For the airfoil section Goe801 pressure distributions were calculated and compared with experimental data. Author (ESA)

N77-21057# Royal Aircraft Establishment, Farnborough (England). Dept. of Aerodynamics.

ITERATIVE METHOD FOR THICK CAMBERED WINGS IN SUBCRITICAL FLOW

C. C. L. Sells London Aeron. Res. Council 1976 73 p refs Supersedes RAE-TR-73047; RAE-TR-74044; ARC-34959; ARC-35354

(ARC-R/M-3786; RAE-TR-73047; RAE-TR-74044; ARC-34959; ARC-35354) Avail: NTIS HC A04/MF A01; HMSO £4.50; PHI $17.35

A method of computing the steady, inviscid flow around a thick, cambered and twisted wing (neglecting dihedral) is presented. The flow field is represented by distributions of sources and doublets in the chordal surface, the strengths of which are determined iteratively from the boundary conditions on the wing upper and lower surfaces. To save computing time, these conditions are transferred to the surface of the related uncambered wing by a two-term Taylor series expansion in the camber ordinate. This approximate boundary condition is correct to second order. In order to improve the approximations for the singularity distributions at each stage, and so to speed up convergence, an inner iteration scheme is employed, based on a similar Taylor expansion centered on the mean chordal surface. The method is extended to compressible (subcritical) flow with the help of the Prandtl-Glauert rule. The method is tested on R.A.E. Wing B, a research wing with rapid spanwise changes in camber and twist near the root and tip. Results from two runs with different numbers of chordwise and spanwise stations agree well, which suggests that the method is well-coordinated and reliable; agreement with some results form the B.A.C. (Roberts) program is satisfactory; and the predictions of the latest version of the R.A.E. Standard Method agree with these reasonably well, in view of the marked spanwise deformation of the wing. Author (ESA)

N77-21058# Royal Aircraft Establishment, Farnborough (England). Dept. of Aerodynamics.

CALCULATION OF THE LAMINAR BOUNDARY LAYER AND PREDICTION OF TRANSITION ON A SHEARED WING

J. A. Beasley London Aeron. Res. Council 1976 89 p refs Supersedes RAE-TR-73156; ARC-35316

(ARC-R/M-3787; RAE-TR-73156; ARC-35316) Avail: NTIS HC A05/MF A01 HMSO £5; PHI $19.20

A method is described of calculating the laminar boundary layer in incompressible flow on a sheared, infinite wing; the boundary layer equations are solved by a finite difference procedure. Transition from laminar to turbulent flow following leading-edge contamination, cross-flow instability or instability of the Tollmien-Schlichting type, and re-laminarization are considered. The suitability of existing criteria for predicting transition, when applied to a sheared wing, is investigated by comparing theoretical estimates with the experimental results of Boltz, Kenyon, and Allen. Author (ESA)

N77-21059# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

HEAT TRANSFER TO A DELTA WING AND TWO WAVE-RIDER WINGS IN A RAREFIED HYPERSONIC FLOW

E. M. Galloway, R. W. Jeffery, and J. K. Harvey Sep. 1976 37 p refs

(IC-Aero-76-04; ARC-36903; ISSN-0308-7247) Avail: NTIS HC A03/MF A01

A family of triangular planform wings of semi-span to chord ratio 0.267 was tested over a range of incidence under rarefied conditions at Mach 22 in the graphite-heated nitrogen wind tunnel. One wing had a plane compression surface and the other two were wave-riders with 8 deg and 5 deg undercut angles. Detailed heat transfer measurements were made using two complementary techniques. Heat transfer contours were located using phase change paint, and these were quantified with values obtained using thermocouples on a thin shell. These results are compared with two-dimensional viscous wedge theories. Author (ESA)

N77-21060# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.

SUPERCRITICAL WING PROFILE DFVLR-R2. RESULTS OF CALCULATIONS [UEBERKRITISCHES TRAGFLUEGELPROFIL DFVLR-R2. ERGEBNISSE DER NACHRECHNUNGEN]

H. Koester and G. Redeker Aug. 1976 66 p refs In GERMAN

(DLR-IB-151-76/7) Avail: NTIS HC A04/MF A01

Results are presented of extensive pressure distribution measurement calculations of the supercritical wing profile DFVLR-R2 in the Mach number range between 0.6 and 0.76 and the lift coefficient range between 0.4 and 0.7. The calculations were essentially carried out taking into account the boundary layer displacement thickness at the Reynolds number Re = 1.10 to the 7th power. The pressure distributions, the derived lift, drag, and yaw moment coefficients, as well as the limits for the lift increase and buffeting, demonstrate the properties of the profile in the range investigated. ESA

N77-21061# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

WIND TUNNEL TESTS AND AERODYNAMIC COMPUTATIONS: THOUGHTS ON THEIR USE IN AERODYNAMIC DESIGN

J. M. Slooff 10 Jun. 1976 8 p refs Presented at the AGARD FDP Specialists' Meeting on Numerical Methods and Wind Tunnel Testing, Rhode-St-Genese, Belg., 23-24 Jun. 1976

(NLR-MP-76013-U) Avail: NTIS HC A02/MF A01

In the past 10 to 15 years, important developments have taken place in numerical methods for flow computations as well as in wind tunnel testing technology. Numerical methods in particular have provided the aerodynamic designer with a new set of tools. The possibilities and limitations of numerical methods and wind tunnel tests are compared, and a discussion is presented on their respective roles in aerodynamic design. It is concluded that the key problems of aerodynamic design are not solved by substituting numerical methods for the wind tunnel. The development of numerical methods that produce optimized geometries on the basis of simplified physics deserves at least as much attention as the pursuit of full Navier-Stokes solutions for given geometries. Author (ESA)

N77-21062# Aeronautical Research Inst. of Sweden, Stockholm.

CALCULATIONS OF TWO-DIMENSIONAL BOUNDARY LAYER PARAMETERS IN SUBSONIC FLOW AROUND LEADING EDGE SLATS AND WING NOSES Ph.D. Thesis, Final Report

Stein I. Eriksen Aug. 1976 66 p refs

(Contract SWEDBTD-75-4581)

(FFA-TN-AU-1272) Avail: NTIS HC A04/MF A01

Computations were done for two-dimensional wing configurations equipped with leading edge slats and trailing edge flaps. A standard NACA 642-418 airfoil was used as a basic geometry for the calculations. The validity of available computer programs concerning calculations of potential-flow fields and boundary layer parameters of two-dimensional multi-element airfoils was examined, and these programs were used in optimizing the main foil's nose geometry concerning boundary layer growth further back on the foil. Eventual mixing of slat wake and wing boundary layer was neglected. The Reynolds number used for comparison was 3.19 x 10 to 6th power. An acceptable correlation between

the calculated boundary layer parameters and the available experimental data was achieved. Several nose-geometries were developed, and, on the two best, computations for larger Reynolds numbers and flap angles were carried out. At the lower Reynolds number, laminar separation occurred for all configurations examined and for all actual angles of attack. Boundary layer thickness and position of turbulent separation point seem to depend mainly on how early/late transition from laminar to turbulent boundary layer flow occurs. The calculations show that the wing-nose geometry effects boundary layer growth considerably. A rather noticeable difference in displacement thickness (25 to 30%) near the wing trailing edge between the best and the poorest wing configuration appeared. Author (ESA)

N77-21063# Aeronautical Research Inst. of Sweden, Bromma. Aerodynamics Dept.

AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF DIFFERENT TRANSITION DEVICES ON BOUNDARY LAYER TRANSITION ON A FLAT PLATE WITH PROFILED LEADING EDGE

E. Totland Dec. 1976 106 p refs
(Contract SWEDBTD-75-4494)
(FFA-AU-1274) Avail: NTIS HC A06/MF A01

Natural and forced transition on a flat plate with a profiled leading edge were studied as a part of an investigation on roughness effects on aircraft performance. Measurements were made with a single hot wire to obtain the boundary layer mean velocity profile and the RMS of the fluctuating streamwise velocity. Two ranges of Reynolds numbers were used: between 2.10 to 5th power and 16.10 to 5th power, and between 300 and 2500. Three categories of transition trips were used: in-line roughness spots, a single spanwise wire, and distributed roughness in the form of oil fluid mixture. In the case of the in-line roughness type, the criterion Re sub kk = U sub k k/nu equals about 600 for full effectiveness, was found to be valid. The transition trips tested are representative of typical roughness close to the leading edge. Author (ESA)

N77-21064# ARO, Inc., Arnold Air Force Station, Tenn.

EVALUATION OF THE AERODYNAMIC INTERFERENCE OF THE TUNNEL 4T CAPTIVE TRAJECTORY SYSTEM ON THE SEPARATION CHARACTERISTICS OF THE BLU-27 STORE Final Report, Dec. 1975 - Jul. 1976

Wallace Luchuk and David W. Hill, Jr. AEDC Nov. 1976 55 p refs
(AD-A032063; ARO-PWT-TR-76-98; AEDC-TR-76-142) Avail: NTIS HC A04/MF A01 CSCL 20/4

This report contains the results of an experimental program to evaluate the effect of the 4T Captive Trajectory System on the separation characteristics of typical stores. The models selected as being generally representative of external stores were the modified BLU-27B/B configuration with and without fins. The aircraft model selected for this test was the F-111. To assess the aerodynamic interference of the Captive Trajectory System on the store and its trajectory, four sting lengths were used to position the store model at varying distances from the support system. Data were obtained at Mach numbers of 0.4, 0.8, 0.9, 1.1, and 1.2. Captive trajectories simulating store separation from the aircraft model were obtained; forces on the store were measured while the store was moved vertically away from the marriage position; and force data on the store were obtained as it was yawed in a location as far removed as possible from the aircraft model. It was concluded that the Captive Trajectory System has little or no effect on the store loads and trajectory development. Author (GRA)

N77-21065# ARO, Inc., Arnold Air Force Station, Tenn.

AN EVALUATION OF JET SIMULATION PARAMETERS FOR NOZZLE AFTERBODY TESTING AT TRANSONIC MACH NUMBERS Final Report, Jan. 1975 - Jun. 1976

William Lee Peters AEDC Oct. 1976 98 p refs
(ARO Proj. P32P-AOA)
(AD-A031525; ARO-PWT-TR-76-67; AEDC-TR-76-109) Avail: NTIS HC A05/MF A01 CSCL 21/5

The objective of this investigation was to evaluate various jet simulation parameters in an attempt to establish a method of matching hot jet interference with cold jet flows. Successful parameters were determined based on their ability to correlate integrated afterbody pressure drag, a measurement of aerodynamic interference, for jet flows of varying total temperature. Data used in this investigation were obtained from experiments conducted in the AEDC Propulsion Wind Tunnel (16T) with three different isolated nozzle/afterbody configurations at free-stream Mach numbers from 0.6 to 1.5. Gas temperature effects on pressure drag were acquired with a convergent nozzle utilizing an air/ethylene burner to produce gas temperatures from 540 to 3,300 R. In addition, the jet effects of varying internal nozzle geometry, specifically nozzle divergence half-angle and nozzle exit-to-throat area ratio, were investigated utilizing high-pressure air as the nozzle exhaust gas. Jet simulation parameters were evaluated for jet flows where nozzle exit-to-throat area ratio was varied from 1.0 to approximately 1.5 and where divergence half-angle was varied from 0 to 10 deg. GRA

N77-21066# ARO, Inc., Arnold Air Force Station, Tenn.

TESTS OF THE ONERA CALIBRATION MODELS IN THREE TRANSONIC WIND TUNNELS Final Report, Apr. 1974 - May 1976

T. W. Binion, Jr. AEDC Nov. 1976 76 p refs
(AD-A031997; ARO-TWT-TR-76-68; AEDC-TR-76-133) Avail: NTIS HC A05/MF A01 CSCL 14/2

A cooperative effort between the Office National d'Etudes et de Recherches Aerospatiales (ONERA); the National Aeronautic and Space Administration, Ames Research Center (NASA-ARC); and the Arnold Engineering Development Center (AEDC) was accomplished whereby two ONERA standard calibration models (M3 and M5) and an area equivalent body of revolution (C5) were tested in the NASA-ARC 11-ft and the AEDC 16-ft and 4-ft transonic wind tunnels. The tests were designed to provide an experimental data base for (1) the evaluation of theoretical or empirical wall-interference correction factors and (2) the establishment of guidelines to allow reasonable selection of wind tunnel to model size ratios in the transonic speed regime. The results showed that large effects of Reynolds number, tunnel flow quality, and small difference in model geometry preclude a determination of wall interference from the M3 and M5 model data. The primary cause of the data differences is a variation in the wing shock/separation patterns between the three tunnel tests. Even though the model forces may, in certain instances, agree from tunnel to tunnel, pressure distributions showed the agreement to be fortuitous. The C5 model data indicated subsonic theory underpredicts the required blockage correction by a factor of two to ten and, because the blockage interference effect changes sign along the model, simply correcting the Mach number will not compensate for the transonic interference. Author (GRA)

N77-21024*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CURVE FITTING OF AEROELASTIC TRANSIENT RESPONSE DATA WITH EXPONENTIAL FUNCTIONS

Robert M. Bennett and Robert N. Desmarais *In its* Flutter Testing Tech., 1976 p 43-58 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01A

N77-21031*# General Dynamics Corp., San Diego, Calif.

THE DESIGN, ANALYSIS, AND TESTING OF A LOW-BUDGET WIND-TUNNEL FLUTTER MODEL WITH ACTIVE AERODYNAMIC CONTROLS

R. Bolding and R. Stearman (Texas Univ., Austin) *In* NASA. Langley Res. Center Flutter Testing Tech., 1976 p 213-242 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01A

N77-21032*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CORRELATION WITH FLIGHT OF SOME AEROELASTIC MODEL STUDIES IN THE NASA LANGLEY TRANSONIC DYNAMICS TUNNEL

Wilmer H. Reed, III *In* Its Flutter Testing Tech., 1976 p 243-262 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01A

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

No abstracts in this category.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N77-21067# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RADAR DETECTION OF THUNDERSTORM HAZARDS FOR AIR TRAFFIC CONTROL. VOLUME 2: RADAR SYSTEMS
S. M. Sussman 7 Oct. 1976 72 p refs
(Contract DOT-FA74WAI-485)
(AD-A032736/1; ATC-67-Vol-2; FAA-RD-76-52-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 17/7

Radar systems are investigated for the acquisition of weather data to support detection and forecasting of hazardous turbulence associated with individual storm cells. Utilization of the FAA Airport Surveillance Radar is explored. The issues of antenna polarization and sensitivity time control that impact on shared operation for aircraft and weather detection are addressed. Candidate system configurations employing a common RF channel and dual orthogonal polarization channels are discussed. Ground clutter discrimination by coherent Doppler and noncoherent processing methods is described. Author

N77-21068# National Aviation Facilities Experimental Center, Atlantic City, N. J.
TEST AND EVALUATION OF A FEASIBILITY MODEL ILS GLIDE SLOPE PERFORMANCE ASSURANCE MONITOR FOR THE FINAL APPROACH PATH Final Report, Dec. 1973 - Mar. 1976
Marvin S. Plotka Dec. 1976 106 p refs
(AD-A034892/0; FAA-NA-76-20; FAA-RD-76-176) Avail: NTIS HC A06/MF A01 CSCL 17/7

The second of two test and evaluations was performed to determine the feasibility of a ground-based monitoring system to accurately measure the flight-path of selected aircraft on the final approach path. This tracking information would provide a data base for statistical analysis of the instrument landing system (ILS) glide slope performance. This subsystem was tested by comparison of its measured glide slope angle with the glide slope angle generated by the phototheodolite tracking system (time referenced). Author

N77-21069# National Aviation Facilities Experimental Center, Atlantic City, N. J.
AIRSPACE CONFIGURATION AND SEPARATION EVALUATION: CONFIGURATION AND PROCEDURES. TERMINAL ATC DIGITAL DISPLAY SYSTEM ERRORS, ARTS 3 Final Report, Dec. 1973 - Jan. 1976
Harry T. Morgan, Jr. and Arthur R. Moss Nov. 1976 167 p refs
(AD-A034494/5; FAA-NA-76-6; FAA-RD-76-178) Avail: NTIS HC A08/MF A01 CSCL 17/7

The major position and separation errors associated with the digital data provided to the radar controller by the Automated Radar Terminal System (ARTS III) are quantitatively assessed to provide the basis for specifying the air traffic control separation minima in ARTS-controlled airspace. An extensive series of live and simulated flight tests were conducted. The methodology, results, and conclusions of this effort are discussed. The results indicate that 99.9 percent of the overall range and azimuth errors can be expected to fall within + or - 0.16 nmi and + or - 1.43 deg, respectively, about their mean errors with a confidence of 90 percent. These errors are less than those generated in trying to read position from the radar displays. Author

N77-21070# National Aviation Facilities Experimental Center, Atlantic City, N. J.
SIMULATION STUDY OF INTERMITTENT POSITIVE CONTROL IN A TERMINAL AREA AIR TRAFFIC CONTROL ENVIRONMENT Final Report, May - Sep. 1975
S. Rossiter, J. Windle, R. Strack, and W. Mullen Jan. 1977 89 p refs
(AD-A034902/7; FAA-NA-76-32; FAA-RD-76-193) Avail: NTIS HC A05/MF A02 CSCL 17/7

A dynamic simulation was conducted to provide an initial and limited investigation into the operational and procedural problems that may exist when intermittent positive control (IPC) is present within a terminal area air traffic control (ATC) system. The test environment simulated a single discrete address beacon system (DABS) sensor site and used the IPC algorithm. The results indicated that the algorithm tested at NAFEC adversely interacted with the present ATC system in a number of operational areas. IPC generated controller alerts and, at times, commands when controllers were following normal procedures and aircraft pairs were well outside ATC separation standards. Author

N77-21071*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A FLIGHT INVESTIGATION OF A 4D AREA NAVIGATION SYSTEM CONCEPT FOR STOL AIRCRAFT IN THE TERMINAL AREA
Frank Neuman, David N. Warner, and Francis J. Moran Mar. 1977 56 p refs
(NASA-TM-X-73195; A-6879) Avail: NTIS HC A04/MF A01 CSCL 17G

A digital avionics system referred to as STOLAND was test flown in the NASA CV-340 aircraft to obtain performance data for time controlled guidance in the manual flight director mode. The advanced system components installed in the cockpit included an electronic attitude director indicator and an electronic multifunction display. Navigation guidance and control computations were performed on a digital computer. A detailed 4D area navigation systems description is given. The pilot/system interface and systems operation and performance are also described. Approach flightpaths were flown which included a 180 deg turn and a 1-min, 5 deg straight-in approach to 30 m altitude, at which point go-around was initiated. Results are presented for 19 approaches. Author

N77-21072# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DEVELOPMENT OF A DISCRETE ADDRESS BEACON SYSTEM Quarterly Technical Summary, 1 Jul. - 30 Sep. 1976
1 Oct. 1976 70 p
(Contract DOT-FA72WAI-261; F19628-76-C-0002; FAA Proj. 034-241-012)
(AD-A035104/9; FAA-RD-76-174) Avail: NTIS HC A04/MF A01 CSCL 17/7

Included are the results of analytical studies, laboratory and flight experiments, and software developments supporting the concept feasibility and performance definition phase of the FAA DABS Program. Author

N77-21073# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EVALUATION OF A RED-SILICONE-COATED VISUAL APPROACH SLOPE INDICATOR (VASI) LENS Final Report, Sep. 1975 - Jul. 1976
Raymond E. Johnston Jan. 1977 14 p
(FAA Proj. 071-312-070)
(AD-A035141/1; FAA-NA-76-31; FAA-RD-76-201) Avail: NTIS HC A02/MF A01 CSCL 17/7

A method of producing the red/white color-coded signal used in a Visual Approach Slope Indicator (VASI) system was tested. A new method of providing the signal was developed by

coating the upper part of a circular clear lens with a heat-resistant red-silicone-pigment paint, leaving the lower part clear to transmit the white signal. Laboratory and field tests conducted on the coated lens resulted in no appreciable deterioration of the red signal; therefore, it was determined that this method of providing the signal was comparable to the split lens assembly. Author

N77-21074*# Litton Systems, Inc., Woodland Hills, Calif.
PRELIMINARY DESIGN OF A REDUNDANT STRAPPED DOWN INERTIAL NAVIGATION UNIT USING TWO-DEGREE-OF-FREEDOM TUNED-GIMBAL GYROSCOPES
Oct. 1976 582 p
(Contract NAS1-13847)
(NASA-CR-145305; Doc-403314) Avail: NTIS HC A25/MF A01 CSCL 17G

This redundant strapdown INS preliminary design study demonstrates the practicality of a skewed sensor system configuration by means of: (1) devising a practical system mechanization utilizing proven strapdown instruments, (2) thoroughly analyzing the skewed sensor redundancy management concept to determine optimum geometry, data processing requirements, and realistic reliability estimates, and (3) implementing the redundant computers into a low-cost, maintainable configuration. Author

N77-21075# Royal Aircraft Establishment, Farnborough (England).
THE PRECISION APPROACH PATH INDICATOR - PAPI
A. J. Smith and D. Johnson Sep. 1976 25 p refs
(RAE-TR-76123; BR54759) Avail: NTIS HC A02/MF A01

The Precision Approach Path Indicator (PAPI) is a simple visual aid that has been developed to assist pilots during their approach to landing. It enables pilots to acquire the correct glideslope and subsequently to maintain their position on it, thus ensuring an accurate approach and landing. The short-comings of current in-service glideslope indicator systems are identified, the operational requirements for current and future needs are discussed, and why the PAPI system best meets these needs is shown. Author (ESA)

N77-21076# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
SOLID STATE INTEGRATOR SHAFT ASSEMBLY Final Report
C. H. McGowan Nov. 1976 456 p
(Contract N00123-75-C-1339)
(AD-A032032; R-1004) Avail: NTIS HC A20/MF A01 CSCL 09/2

The report covers the design build and flight test of two prototype solid state integrator shaft assemblies (SSISAs) as a direct replacement for a high-failure-rate electromechanical integrating shaft assembly (ISA), which is located in the CP-751 AN/ASN-31 navigation computer. The two prototype SSISA units are continuing to be tested in the A-6E and E-2B aircraft. To date, no failures have occurred in either of the SSISA units, or the CP-751 computers, of which they are an integral assembly. GRA

N77-21077# DBA Systems, Inc., Melbourne, Fla.
STUDY OF THE IMPACT OF THE GLOBAL POSITIONING SYSTEM ON ARMY SURVEY
F. James Heindl Sep. 1976 122 p refs
(Contract DAAG53-76-M-5597)
(AD-A030708; ETL-0070) Avail: NTIS HC A06/MF A01 CSCL 17/7

This report was initiated to determine the impact of one new technology, the Global Positioning System(GPS), on Army survey. This report presents a brief synopsis of current field army survey units, methods, and equipment. It also gives a general description of the envisioned Global Positioning System with specific emphasis on the user segment, which will be deployed to the field. In addition, possible initial applications of GPS though augmentation of current survey methods and the possibility of deriving advanced concepts for operational deployment and techniques are presented. The conclusions are discussed which show that the GPS will significantly impact position and velocity determination, particularly in four primary areas: response time, manpower, equipment, and accuracy. Author (GRA)

N77-21078# New York State Dept. of Motor Vehicles, Albany.
LORAN-C FEASIBILITY DEMONSTRATION PLAN Final Report, Jul. 1975 - Aug. 1976
Oct. 1976 45 p Prepared in cooperation with Polhemus Navigation Sci., Inc.
(Contract DOT-HS-5-01234)
(PB-260675/4; DOT-HS-802-057) Avail: NTIS HC A03/MF A01 CSCL 17G

Terrestrial applications of LORAN-C, a radio navigation system, are discussed. Need for and costs of calibrating and converting LORAN-C time difference values to other site location forms, control display requirements as a function of system application, costs and problems involved in training users, and steps required to implement a LORAN-C system in each of the application areas are among the factors considered. Demonstration scope, fiscal, temporal, evaluative criteria, and manpower requirements are also included. Applications are distributed in three major categories: automatic vehicle monitoring, automatic vehicle location, and site registration. GRA

N77-21079# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
ESTIMATION THEORY BASIC TO NAVIGATION AND GUIDANCE SYSTEM DESIGN Final Report, 15 Sep. 1975 - 14 Sep. 1976
Richard S. Bucy Sep. 1976 5 p refs
(Grant AF-AFOSR-2141-71)
(AD-A032925; AFOSR-76-1138TR) Avail: NTIS HC A02/MF A01 CSCL 12/2

The research program consisted of two parts, parallel and pipeline synthesis of nonlinear filters and a priori bounds for the mean square error of nonlinear filters. It was noted very early in the program that the choice of computational realization device could produce dramatic changes in estimate production speed, especially parallel and pipeline devices. Specific programs were tailored to three difference computers to realize the nonlinear filter and take full advantage of the problem's parallel structure for each machine. The speed of estimate production was increased by a factor of 140. The second area concerned finding performance bounds on the error variance of the nonlinear filter for a specific problem, the cubic sensor. Using sensor orbit estimators and nonlinear functions of such estimates, rather effective bounds were discovered. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N77-21080*# Boeing Vertol Co., Philadelphia, Pa.
RESEARCH REQUIREMENTS FOR DEVELOPMENT OF ADVANCED-TECHNOLOGY HELICOPTER TRANSMISSIONS
A. J. Lemanski Dec. 1976 79 p refs
(Contract NAS1-13624)
(NASA-CR-145114) Avail: NTIS HC A05/MF A01 CSCL 01C

Helicopter drive-system technology which would result in the largest benefit in direct maintenance cost when applied to civil helicopters in the 1980 timeframe was developed. A prototype baseline drive system based on 1975 technology provided the basis for comparison against the proposed advanced technology in order to determine the potential for each area recommended for improvement. A specific design example of an advanced-technology main transmission is presented to define improvements for maintainability, weight, producibility, reliability, noise, vibration, and diagnostics. Projections of the technology achievable in the 1980 timeframe are presented. Based on this data, the technologies with the highest payoff (lowest direct maintenance cost) for civil-helicopter drive systems are identified. Author

N77-21081*# Virginia Univ., Charlottesville. Dept. of Electrical Engineering.

REAL TIME FLIGHT SIMULATION METHODOLOGY Final Report
E. A. Parrish, G. Cook, and E. S. McVey Apr. 1977 71 p refs
(Grant NsG-11511)
(NASA-CR-152652; UVA/528085/EE77/104) Avail: NTIS HC A04/MF A01 CSCL 01C

Substitutional methods for digitization, input signal-dependent integrator approximations, and digital autopilot design were developed. The software framework of a simulator design package is described. Included are subroutines for iterative designs of simulation models and a rudimentary graphics package.
Author

N77-21082*# Transemantics, Inc., Washington, D.C.
CIVIL AIRCRAFT OF THE FUTURE AND NEW TECHNOLOGICAL DEVELOPMENTS
Jacques Morisset NASA Apr. 1977 7 p Transl. into ENGLISH from Air et Cosmos (France), no. 642, 23 Oct. 1976 p 15, 48
(Contract NASw-2792)
(NASA-TT-F-17535) Avail: NTIS HC A02/MF A01 CSCL 01C

Various developments in engine design, aerodynamics, structural design, and systems design are discussed. With application of advanced technology, it will be possible to develop long-range passenger airliners which will be 40% more economical than the best aircraft now in operation.
Author

N77-21083*# Kansas Univ., Lawrence. Flight Research Lab.
FLIGHT TEST RESULTS FOR A SEPARATE SURFACE STABILITY AUGMENTED BEECH MODEL 99 Final Report
Gerald E. Jenks, Howard F. Henry, and Jan Roskam Apr. 1977 340 p refs
(Contract NAS4-2148)
(NASA-CR-143839; KU-FRL-364) Avail: NTIS HC A15/MF A01 CSCL 01C

A flight evaluation of a Beech model 99 equipped with an attitude command control system incorporating separate surface stability augmentation (SSSA) was conducted to determine whether an attitude command control system could be implemented using separate surface controls, and to determine whether the handling and ride qualities of the aircraft were improved by the SSSA attitude command system. The results of the program revealed that SSSA is a viable approach to implementing attitude command and also that SSSA has the capability of performing less demanding augmentation tasks such as yaw damping, wing leveling, and pitch damping. The program also revealed that attitude command did improve the pilot rating and ride qualities of the airplane while flying an IFR mission in turbulence. Some disadvantages of the system included the necessity of holding aileron force in a banked turn and excessive stiffness in the pitch axis.
Author

N77-21084*# Boeing Aerospace Co., Seattle, Wash.
GROUND EFFECTS AND CONTROL EFFECTIVENESS TESTS OF A .095 SCALE POWERED MODEL OF A MODIFIED T-39 LIFT/CRUISE FAN V/STOL RESEARCH AIRPLANE
C. R. Dawson and E. Omar 22 Feb. 1977 221 p refs
(NASA-CR-151993; D180-20391-1) Avail: NTIS HC A10/MF A01 CSCL 01C

Wind tunnel test data are analysed to determine ground effects and the effectiveness of the aerodynamic control surfaces to provide a technology base for a Navy type A V/STOL airplane. Three 14CM (5.5 inch) turbopowered simulators were used to power the model which was tested primarily in the following configurations: (1) VTOL with flaps deployed, gear down, and engines tilted to 80 deg, 90 deg, and 95 deg, (2) STOL with flap and gear down and engines tilted to 50 deg; and (3) Loiter with flaps and gear up and L/C nacelles off. Data acquired during the tests are included as an appendix.
Author

N77-21085# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abt. Regelungssysteme.
DESIGN CONCEPTS FOR A FULLY ACTIVE HELICOPTER VIBRATION ISOLATION SYSTEM BY MEANS OF OUTPUT VECTOR FEEDBACK [KONZEPTE ZUR AUSLEGUNG EINES VOLLAKTIVEN HUBSCHRAUBER-SCHWINGUNGS ISOLATIONSSYSTEMS MITTELS AUSGANGSVEKTOR-RUECKFUEHRUNG]
G. Schulz Sep. 1976 63 p refs In GERMAN
(DLR-IB-552-76/12) Avail: NTIS HC A04/MF A01

Concepts taken from the theory of output vector feedback (few parameters) were used to develop a controller for fully active vibration isolation of helicopters. These controller concepts were tested on several models of the BO-105 helicopter, and their efficiency is demonstrated. A compensation of the rotor-originated blade number harmonic vibration excitations and of the fast automatic trimming in the case of maneuvers was achieved.
ESA

N77-21086# Naval Air Test Center, Patuxent River, Md.
MORE EFFECTIVE AIRCRAFT STABILITY AND CONTROL FLIGHT TESTING THROUGH USE OF SYSTEM IDENTIFICATION TECHNOLOGY
Roger A. Burton and David E. Bischoff 4 Nov. 1976 21 p refs
(AD-A032293; NATC-TM-76-2-SA) Avail: NTIS HC A02/MF A01 CSCL 20/4

The development of system identification technology was undertaken to provide for more effective aircraft flight testing by reducing the time required to conduct specific tests and/or to provide for a more comprehensive data analysis. F-14A and TA-4J flight test results presented demonstrate that the flight time required to obtain stability and control data can be significantly reduced without loss in accuracy of conventional flight test derived parameters. Presentation of S-3A and EA-6B system identification results demonstrate that this technology can be successfully used to update the aerodynamic data bases of modern jet aircraft from flight test data. These system identification results are compared with wind tunnel data and flight test derived parameters to demonstrate the accuracy of this new technology. Applications of this technology to integrate several areas of aircraft flight testing are discussed.
Author (GRA)

N77-21025*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DETERMINATION OF SUBCRITICAL DAMPING BY MOVING-BLOCK/RANDOMDEC APPLICATIONS
Charles E. Hammond (Army Air Mobility R&D Lab., Langley, Va.) and Robert V. Doggett, Jr. *In* Its Flutter Testing Tech., 1976 p 59-76 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-21026*# Boeing Commercial Airplane Co., Seattle, Wash.
TRANSIENT EXCITATION AND DATA PROCESSING TECHNIQUES EMPLOYING THE FAST FOURIER TRANSFORM FOR AEROELASTIC TESTING
W. P. Jennings, N. L. Olsen, and M. J. Walter *In* NASA. Langley Res. Center Flutter Testing Tech., 1976 p 77-114 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-21027*# Lockheed-California Co., Burbank.
TURBULENCE EXCITED FREQUENCY DOMAIN DAMPING MEASUREMENT AND TRUNCATION EFFECTS
Jaak Soovere *In* NASA. Langley Res. Center Flutter Testing Tech., 1976 p 115-142 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-21028*# Systems Control, Inc., Cambridge, Mass.
SPECIFICATION OF INPUTS AND INSTRUMENTATION FOR FLUTTER TESTING OF MULTIVARIABLE SYSTEMS
Narendra K. Gupta and W. Earl Hall, Jr. *In* NASA. Langley Res. Center Flutter Testing Tech., 1976 p 143-180 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-21029*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME EXPERIENCE USING SUBCRITICAL RESPONSE METHODS IN WIND-TUNNEL FLUTTER MODEL STUDIES
Jerome T. Foughner, Jr. *In its* Flutter Testing Tech., 1976

p 181-192 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01A

N77-21030*# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
WIND TUNNEL INVESTIGATION OF SUPERSONIC WING-TAIL FLUTTER
Lawrence J. Huttsell, Thomas E. Noll, and Donald E. Holsapple *In* NASA. Langley Res. Center Flutter Testing Tech., 1976 p 193-212 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-21033*# Air Force Flight Test Center, Edwards AFB, Calif.
TIME SERIES ANALYSIS IN FLIGHT FLUTTER TESTING AT THE AIR FORCE FLIGHT TEST CENTER: CONCEPTS AND RESULTS
Russell W. Lenz and Bruce McKeever (TIME/DATA Corp.) *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 287-318 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-21034*# Grumman Data Systems Corp., Bethpage, N.Y.
FLIGHT FLUTTER TESTING TECHNOLOGY AT GRUMMAN
H. J. Perangelo and F. W. Milordi (Grumman Aerospace Corp.) *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 319-376 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-21036*# Gates Learjet Corp., Denver, Colo.
THE APPLICATION OF RECENT TECHNIQUES IN FLIGHT FLUTTER TESTING
M. A. Abla *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 395-412 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-21037*# Lockheed Aircraft Corp., Burbank, Calif.
F-15 FLIGHT FLUTTER TEST PROGRAM
Henry Katz, G. Francis Foppe, and Daniel T. Grossman *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 413-432 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01G

N77-21038*# General Dynamics/Fort Worth, Tex.
YF-16 FLIGHT FLUTTER TEST PROCEDURES
Warren J. Brignac, Halvor B. Ness, Maynard K. Johnson, and Larz M. Smith *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 433-456 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-21041*# Bell Helicopter Co., Fort Worth, Tex.
FLIGHT FLUTTER TESTING OF ROTARY WING AIRCRAFT USING A CONTROL SYSTEM OSCILLATION TECHNIQUE
Jing G. Yen, Sathy Viswanathan, and Carl G. Matthys *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 501-512 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N77-21039*# Sikorsky Aircraft, Stratford, Conn.
INFLIGHT ROTOR STABILITY MONITOR
William A. Kuczynski *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 457-472 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01D

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-21087*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A PRELIMINARY STUDY OF THE USE OF INTERCOOLING AND REHEAT IN CONJUNCTION WITH REGENERATION FOR AIRCRAFT TURBINE ENGINES
Joseph D. Eisenberg Mar. 1977 39 p refs
(NASA-TM-X-73617; E-9106) Avail: NTIS HC A03/MF A01 CSCL 21E

The effect on fuel consumption of turbofans with intercooled, regenerative cycles and with intercooled, regenerative, reheat cycles was studied. The technology level for both engine and aircraft was that projected for 1985. The simulated mission was a 5556 km flight carrying 200 passengers at Mach 0.8 at 11582 min. Results indicate that these relatively complex cycles offer little, if any, fuel savings potential relative to a conventional turbofan cycle of comparable advanced technology. The intercooled, regenerative cycle yields about the same fuel economy as a conventional cycle at close to the same overall pressure ratio. Author

N77-21088*# Mississippi State Univ., Mississippi State. Dept. of Aerophysics and Aerospace Engineering.
AN INVESTIGATION OF THE AERODYNAMICS AND COOLING OF A HORIZONTALLY-OPPOSED ENGINE INSTALLATION
S. J. Miley 1977 23 p refs Presented at the SAE Business Aircraft Meeting, Century 2, Wichita, Kas., 29 Mar. - 1 Apr. 1977
(Grant NsG-1083)
(NASA-CR-152734) Avail: NTIS HC A02/MF A01 CSCL 21A

A research program to investigate the aerodynamics of reciprocating aircraft engine cooling installations is discussed. Current results from a flight test program are presented concerning installation flow measurement methods. The influence of different inlet designs on installation cooling effectiveness and efficiency are described. Author

N77-21089*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
LINEARIZED BLADE ROW COMPRESSION COMPONENT MODEL. STABILITY AND FREQUENCY RESPONSE ANALYSIS OF A J85-3 COMPRESSOR
W. A. Tesch, R. H. Moszee, and W. G. Steenken Sep. 1976 88 p refs
(Contract NAS3-19854)
(NASA-CR-135162; R76AEG454) Avail: NTIS HC A05/MF A01 CSCL 21E

NASA developed stability and frequency response analysis techniques were applied to a dynamic blade row compression component stability model to provide a more economic approach to surge line and frequency response determination than that provided by time-dependent methods. This blade row model was linearized and the Jacobian matrix was formed. The clean-inlet-flow stability characteristics of the compressors of two J85-13 engines were predicted by applying the alternate Routh-Hurwitz stability criterion to the Jacobian matrix. The predicted surge line agreed with the clean-inlet-flow surge line predicted by the time-dependent method to a high degree except for one engine at 94% corrected speed. No satisfactory explanation of this discrepancy was found. The frequency response of the linearized system was determined by evaluating its Laplace transfer function. The results of the linearized-frequency-response analysis agree with the time-dependent results when the time-dependent inlet total-pressure and exit-flow function amplitude boundary conditions are less than 1 percent and 3 percent, respectively. The stability analysis technique was extended to a two-sector

parallel compressor model with and without interstage crossflow and predictions were carried out for total-pressure distortion extents of 180 deg, 90 deg, 60 deg, and 30 deg. Author

N77-21090*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

RESULTS FROM AN EXPLORATORY STUDY OF AIRFRAME NOISE ON A SMALL-SCALE MODEL OF A SUPERSONIC TRANSPORT CONCEPT

John S. Preisser Apr. 1977 24 p refs

(NASA-TM-X-74021) Avail: NTIS HC A02/MF A01 CSCL 20A

An exploratory study of airframe noise on a small-scale model of a supersonic transport concept was made. The model was a 0.015 scale version without landing gear of Langley's Advanced Supersonic Technology configuration concept, AST-110. Noise measurements were made at positions corresponding to directly beneath the model and at 30 deg - sideline, for both cruise and the approch flaps configurations, at velocities up to 34 m/s. In general, results showed the cruise noise to be about 3dB above the background flow noise and the approach noise to be about 11 dB above. Overall sound pressure levels and spectral shapes agreed with state of the art predictive techniques.Author

N77-21091*# General Electric Co., Schenectady, N.Y.

EFFECT OF INLET DISTURBANCES ON FAN INLET NOISE DURING A STATIC TEST

K. L. Bekofske, R. E. Sheer, Jr., and J. C. F. Wang Apr. 1977 89 p refs

(NASA-CR-135177; SRD-77-059) Avail: NTIS HC A05/MF A01 CSCL 20A

Measurements of fan rotor inlet noise taken during static test situations are at variance with aircraft engine flight data. In particular, static tests generally yield a significantly higher tone at blade passage frequency than that measured during flight. To explain this discrepancy, the extent of the influence of inlet ground vortices and large-scale inlet turbulence on the forward-radiated fan noise measured at a static test facility was investigated. While such inlet disturbances were generated intentionally in an anechoic test chamber, far-field acoustic measurements and inlet flow-field hot-film mappings of a fan rotor were obtained. Experimental results indicate that the acoustic effect of such disturbances appears to be less severe for supersonic than for subsonic tip speeds. Further, a reverse flow that occurs on the exterior cowl in static test facilities appears to be an additional prime candidate for creating inlet disturbances and causing variance between flight and static acoustic data. Author

N77-21092*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.

NASA/NAVY LIFT/CRUISE FAN COST REDUCTION STUDIES

Apr. 1977 30 p refs

(Contract NAS3-19411)

(NASA-CR-135155; R76AEG596) Avail: NTIS HC A03/MF A01 CSCL 21E

Cost reduction studies were performed for the LCF459 turbotip fan for application with the YJ97-GE-100 gas generator in a multimission V/STOL research and technology aircraft. A 20 percent cost reduction of the research configuration based on the original preliminary design was achieved. The trade studies performed and the results in the area of cost reduction and weight are covered. A fan configuration is defined for continuation of the program through the detailed design phase. Author

N77-21093# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).

THE CALIBRATION OF INJECTOR-POWERED ENGINE SIMULATORS FOR USE IN PRESSURIZED WIND TUNNELS

Alain Masson and David N. Foster (RAE, Bedford, Engl.) 1976 32 p refs In FRENCH; ENGLISH summary Report published in ENGLISH by Roy. Aircraft Estab. (RAE-TR-76018)

(ONERA-NT-1976-14) Avail: NTIS HC A03/MF A01

The possibility of using the S3 wind tunnel at Modane-Avrieux to calibrate injector-powered engine simulators was investigated using two engine simulators: one built by ONERA to simulate an engine with a by-pass ratio of 10 (M45 S) and one built by RAE to simulate an engine with a by-pass ratio of 5 (RB-211). Tests were carried out over a range of stagnation pressures of both the primary (inducing) flow and the external (induced) flow, under static and low forward speed conditions, with the models at zero angle of incidence. The tests showed that it would be possible to use the S3 wind tunnel to calibrate future engine simulators, and also that, for the conditions tested, the stagnation pressure of the induced flow had only a minimal effect on the nondimensional performance of the engine simulator. The tests made in a specially designed static rig to develop the configuration of the primary nozzles for the ONERA model engines are described. Author (ESA)

N77-21094# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.

INVESTIGATION OF A RAMJET USING BOUNDARY LAYER BLEED IN A TWODIMENSIONAL SHORT CURVED WALL SUBSONIC DIFFUSER Final Report, 1 Aug. 1975 - 30 Jun. 1976

Tah-Teh Yang, J. L. Gaddis, and Ho-Chen Chien Jul. 1976 48 p refs Prepared in cooperation with Clemson Univ.

(Contract F33615-74-C-2039)

(AD-A031788; AFAPL-TR-76-62) Avail: NTIS HC A03/MF A01 CSCL 21/5

This report describes the bleeding requirements of a short contoured wall diffuser and the net performance gain of a ramjet equipped with such a high performance subsonic diffuser in terms of Thrust Coefficient and Range versus ramjet with conventional short diffuser. Analysis shows that at cruising Mach number of 2.5, the ramjet may gain 5% in Range, and at take-over Mach number of 2.1, the ramjet may gain 6% in Thrust Coefficient. Comparison was also made with other types of high performance subsonic diffusers. In establishing the bleed requirements, detail information was included to show the methods of computing the boundary layer development along the curved wall and over the parallel walls. The latter is of three-dimensional nature which required a method using 'cone-segment' simulation.

Author (GRA)

N77-21095# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Ramjet Technology Branch.

LARGE SCALE LOW PRESSURE DUMP COMBUSTOR PERFORMANCE Final Report, May - Dec. 1975

Roger R. Craig, Parker L. Buckley, and Frank D. Stull Aug. 1976 65 p refs Presented at 11th AIAA/SAE Propulsion Conf., Anaheim, Calif., 29 Sep. - 1 Oct. 1975

(AF Proj. 3012)

(AD-A031827; AFAPL-TR-76-53) Avail: NTIS HC A04/MF A01 CSCL 21/5

An experimental investigation has been conducted extending previous results of small scale dump combustors to larger combustors (8 to 12-in D) tested at lower pressures. A parametric study was then conducted around the 12-in baseline configuration, with and without flameholders, in which combustor length-to-diameter (L/D), Combustor Length-to-step height (L/h), characteristic length (L*), fuel injector type, inlet temperature and chamber pressure were varied. Lean blowout limit, combustion efficiency, and combustor pressure drop were obtained from these runs using JP-4 fuel and compared to previous small scale data. A limited number of additional tests were conducted with Shelldyne-H fuel. Results show that good combustion efficiencies can be achieved with relatively low blockage flameholders resulting in higher overall performance for the larger combustors.

Author (GRA)

N77-21096# Naval Research Lab., Washington, D. C.

FATIGUE-CRACK-GROWTH ANALYSIS OF TITANIUM GAS-TURBINE FAN BLADES

W. H. Cullen and F. R. Stonesifer Oct. 1976 31 p refs

(AD-A031836; NRL-MR-3378) Avail: NTIS HC A03/MF A01 CSCL 21/5

First stage forged titanium gas turbine fan blades from a military aircraft were removed from service, cut into specimens, and tested for fatigue crack growth properties. A method for determining stress intensity based on change in compliance with increasing crack length was applied. Results of testing in air and salt water environments are presented. A model, based on stress-strain curve behavior, is developed and applied to

simulate the data. The data are compared to that taken from rolled baseplate forms of the same material and the applicability of the data to fan blade design and life-time estimates is discussed. Author (GRA)

N77-21097# Purdue Univ., Lafayette, Ind.
[RESEARCH ON AERODYNAMICS, TURBOMACHINERY COMBUSTION, CHEMICAL KINETICS, AND TURBULENCE] Semiannual Progress Report, 1 Apr. - 30 Sep. 1976
T. C. Adamson, Jr., J. Broadwell, F. K. Browand, Edgar P. Bruce, and Franklin O. Carta 1 Oct. 1976 117 p refs Prepared by Mich. Univ., Ann Arbor
(Contract N00014-75-C-1143; Proj. SQUID)
(AD-A031863) Avail: NTIS HC A06/MF A01 CSCL 21/5

Reports of progress during the past six months on the 21 research programs comprising Project SQUID are presented. The research programs fall into the areas of Aerodynamics and Turbomachinery, Combustion and Chemical Kinetics, Measurements and Turbulence. Project SQUID is a cooperative program of basic research related to jet propulsion. It is administered by Purdue University and sponsored by the Office of Naval Research. Author (GRA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N77-21098*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECT OF WING FLEXIBILITY ON THE EXPERIMENTAL AERODYNAMIC CHARACTERISTICS OF AN OBLIQUE WING
Edward J. Hopkins and Sam C. Yee (ARO, Inc., Moffett Field, Calif.) Washington Mar. 1977 218 p refs
(NASA-TM-X-3460; A-6736) Avail: NTIS HC A10/MF A01 CSCL 01C

A solid-aluminum oblique wing was designed to deflect considerably under load so as to relieve the asymmetric spanwise stalling that is characteristic of this type of wing by creating washout on the trailing wing panel and washin on the leading wing panel. Experimental forces, and pitching, rolling and yawing moments were measured with the wing mounted on a body of revolution. In order to vary the dynamic pressure, measurements were made at several unit Reynolds numbers, and at Mach numbers. The wing was investigated when unswept (at subsonic Mach numbers only) and when swept 45 deg, 50 deg, and 60 deg. The wing was straight tapered in planform, had an aspect ratio of 7.9 (based on the unswept span), and a profile with a maximum thickness of 4 percent chord. The results substantiate the concept that an oblique wing designed with the proper amount of flexibility self relieves itself of asymmetric spanwise stalling and the associated nonlinear moment curves. Author

N77-21099*# Princeton Univ., N.J.
IN-FLIGHT SIMULATION STUDY OF DECOUPLED LONGITUDINAL CONTROLS FOR THE APPROACH AND LANDING OF A STOL AIRCRAFT Final Report
Benjamin Feinreich, Edward Seckel, and David R. Ellis Washington NASA Apr. 1977 79 p refs
(Contract NAS1-13502)
(NASA-CR-2710; AMS-1311) Avail: NTIS HC A05/MF A01 CSCL 01D

In this decoupled concept, the natural interactions of the flight variables were suppressed, and the pilot operated a separate controller for each (fore-and-aft control column for flight path angle without speed or pitch attitude change, for example). The handling qualities of the decoupled airplane were judged to be very favorable. The precise path control led to small touchdown point dispersion along with consistently low sink rates. The decoupled control system provided significantly better flying qualities than did conventional SAS applied to the same basic airframe. Author

N77-21100*# Analytic Sciences Corp., Reading, Mass.
STABILITY AND CONTROL OF MANEUVERING HIGH-PERFORMANCE AIRCRAFT Final Report
Robert F. Stengel and Paul W. Berry Washington NASA Apr. 1977 206 p refs
(Contract NAS1-13618)
(NASA-CR-2788; TR-587-1) Avail: NTIS HC A10/MF A01 CSCL 01D

The stability and control of a high-performance aircraft was analyzed, and a design methodology for a departure prevention stability augmentation system (DPSAS) was developed. A general linear aircraft model was derived which includes maneuvering flight effects and trim calculation procedures for investigating highly dynamic trajectories. The stability and control analysis systematically explored the effects of flight condition and angular motion, as well as the stability of typical air combat trajectories. The effects of configuration variation also were examined. Author

N77-21101# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
FLIGHT DYNAMICS AND AIRCRAFT PILOTING
Jean-Claude Wanner Sep. 1976 209 p In FRENCH; ENGLISH summary
(ONERA-NT-1976-6) Avail: NTIS HC A10/MF A01

After a presentation of the principle of piloted vehicle mechanics, the study of the aircraft longitudinal movement is undertaken. Assuming that the pilot counters with his lateral controls any sideslip and that the aircraft plane of symmetry is vertical, the trajectory, depending on the positions of the engine throttles and vertical controls in the hands of the pilot, is described in that same vertical plane. The natural modes (angle of attack oscillation, phugoid, aperiodic motion) of the small movements around the straight and level flight, the response to the pilot's commands, and the equilibrium stability are studied. The small lateral movements around the straight and level flight (dynamic stability, definition of the three natural modes: roll, spiral movement, and Dutch roll) are studied, together with the aircraft response to lateral controls. The small movements of the aircraft around the stabilized level flight in rotation (9th order free movement and response to surface controls and engine control) is also discussed. The assumptions of separation of longitudinal and lateral movements around the stabilized straight and level flight are validated. Author (ESA)

N77-21023*# Aeronautical Research Associates of Princeton, Inc., N. J.
ON IDENTIFYING FREQUENCIES AND DAMPING IN SUBCRITICAL FLUTTER TESTING
John C. Houbolt *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 1-42 (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-21040*# Boeing Vertol Co., Philadelphia, Pa.
INVESTIGATION OF AEROELASTIC STABILITY PHENOMENA OF A HELICOPTER BY IN-FLIGHT SHAKE TEST
Wen-Liu Miao, Thomas Edwards, and David E. Brandt *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 473-500 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N77-21102# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.
DETERMINATION OF PRESSURE DISTRIBUTIONS AND

EFFICIENCY OF THE SUBSONIC MODEL WIND TUNNEL FOR THE GUK [ERMITTLUNG DER DRUCKVERTEILUNGEN UND WIRKUNGSGRADE IM MODELL-UNTERSCHALLWINDKANAL ZUM GUK]

C. Stoffers Dec. 1975 29 p refs In GERMAN
(DLR-IB-151-75/21) Avail: NTIS HC A03/MF A01

Pressure distribution measurements were carried out in nine selected cross sections of test sections and the tunnel tube with a view to preparing the initial operation of the subsonic model wind tunnel for the GUK (large subsonic wind tunnel). The stagnation pressure distributions in the cross sections and the efficiencies of the components between the cross sections were determined from the measurements. The results show irregularities in the flow, both in the test sections and in the tunnel tube. These irregularities result from the diffusor behind the short test section and in too strong deflection in the subsequent deflection grids. ESA

N77-21103# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

A COMPARISON OF TWO INERTIAL REFERENCE PROFILOMETERS USED TO EVALUATE AIRFIELD AND HIGHWAY PAVEMENTS M.S. Thesis

Chris Edward Doepke May 1976 176 p refs
(AD-A031754; AFIT-CI-76-69) Avail: NTIS HC A09/MF A01 CSCL 14/2

This thesis documents a comparison of two similar pavement profile measuring systems owned by the United States Air Force and the State Department of Highways and Public Transportation. The comparison includes descriptions of the systems, a copy of the computer program used to interpret the systems' outputs, plotted profiles from each system for visual comparison and all data used in the statistical analysis. Measurements for the comparison were taken on asphalt concrete airfield and highway pavements and on a portland cement concrete runway. Limitations in the comparison experiment restricted conclusions drawn to that of basic comparability for rigid pavements. Definite conclusions could not be drawn concerning flexible pavements. Recommendations include possible mechanical and operational improvements to the systems, and extension or improvement of the comparison. Author (GRA)

N77-21104# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.

A PARAMETRIC COSTING MODEL FOR FLIGHT SIMULATOR ACQUISITION M.S. Thesis

Milton C. Ross and Gerald L. Yarger Sep. 1976 67 p refs
(AD-A032326; SLSR-22-76B) Avail: NTIS HC A04/MF A01 CSCL 14/2

The acquisition of flight simulators has been plagued by cost growth difficulties arising from poor initial cost estimates. A parametric costing model for simulator acquisition was perceived as a tool which could provide required cost estimates early in the acquisition process. This research effort utilized multiple regression analysis to formulate a parametric costing model or cost estimating relationship (CER) for specific application to flight simulator acquisition. A significant relationship was found to exist between cost and several system characteristics. This relationship was validated through various statistical tests and enabled model formulation. The research indicated that continuing collection and utilization of CER data would provide for further refinement of the parametric costing model. GRA

N77-21105# Naval Research Lab., Washington, D. C.

A NEW WAVE-WIND CHANNEL FOR FLUID DYNAMICS RESEARCH AT THE NAVAL RESEARCH LABORATORY Interim Report

Owen M. Griffin and John W. Wright Aug. 1976 22 p refs
(AD-A031318; NRL-MR-3352) Avail: NTIS HC A02/MF A01 CSCL 20/4

A new multipurpose wave-wind channel facility has been constructed for use in the support of on-going fluid dynamics research programs at the Naval Research Laboratory. This facility has been designed to accommodate experiments ranging from the study of wind and wave effects on ocean structures to the dynamic interactions between the wind and ocean waves. The channel has been equipped initially with a mechanically-driven regular wave generator and a wind tunnel for the generation of wind waves. The laboratory facility, the wave channel and wave generators, and the research programs for which the laboratory has been constructed are described in this report. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N77-21106* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SPACE SETTLEMENTS: A DESIGN STUDY

Richard D. Johnson, ed. and Charles Holbrow, ed. (Colgate Univ.) Washington 1977 191 p refs Sponsored in part by Am. Soc. for Eng. Original contains color illustrations
(NASA-SP-413; LC-76-600068) Avail: SOD HC $5.00 CSCL 22A

Nineteen professors of engineering, physical science, social science, and architecture, three volunteers, six students, a technical director, and two co-directors worked for ten weeks to construct a convincing picture of how people might permanently sustain life in space on a large scale, and to design a system for the colonization of space. Because the idea of colonizing space has awakened strong public interest, the document presented is written to be understood by the educated public and specialists in other fields. It also includes considerable background material. A table of units and conversion factors is included to aid the reader in interpreting the units of the metric system used in the report. Author

N77-21107*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

OAST SPACE THEME WORKSHOP 1976

Stanley R. Sadin Washington Apr. 1977 236 p refs Conf. held at Hampton, Va., 26-30 Apr. 1976
(Contract NASw-2973)
(NASA-TM-X-3486) Avail: NTIS HC A16/MF A01 CSCL 22A

Papers that provide a technical foundation including research and technology base candidates for each of six space themes - space power, space industrialization, search for extraterrestrial intelligence, exploration of the solar system, global service, and advanced transportation systems - are presented. The material is mainly intended for further use by workshop participants and NASA elements concerned with space research and technology. While the data presented do not represent official plans or positions, they are part of the process of evolving such plans and positions. The information contained reflects the efforts of workshop participants and should be an aid in the successful implementation and execution of the Agency's near- and far-term advanced technology program. Author

N77-21108*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.

PREDICTION OF SKYLAB ATTITUDE MOTION FOR SPACE SHUTTLE REVISIT

Stephen G. Alexander and Bonita K. Glutch Apr. 1977 29 p refs
(Grant NsG-7078)
(NASA-CR-152737; RR-77-3) Avail: NTIS HC A03/MF A01 CSCL 22A

Computer simulations were employed to generate results, based on a fairly complicated analytical model. Environmental effects considered include atmospheric drag and gravity gradients. Mathematical models were based on Euler's moment equations and transformations from the body frame to inertial frame. A range of altitudes was considered, from 278 kilometers to 417 kilometers. Skylab is predicted to be in this orbital range during the 1979-1980 period. Results indicated that there will be a cyclic attitude motion due to the combined effect of gravity gradient and atmosphere drag. This motion can be characterized as being a slow tumble. Author

N77-21109*# Kanner (Leo) Associates, Redwood City, Calif.

SPACE FLIGHTS IN THE SOYUZ SPACECRAFT: BIOMEDICAL RESEARCH

O. D. Gazenko, L. I. Kakurin, and A. G. Kuznetsov Washington NASA Mar. 1977 512 p refs Transl. into ENGLISH of the book "Kosmicheskiye polety na korablyakh Soyuz. Biomeditsinskiye issledovaniya" Moscow, Nauka press, 1976 p 1-416
(Contract NASw-2790)
(NASA-TT-F-17524) Avail: NTIS HC A22/MF A01 CSCL 22A

Ten years of experience in manned spaceflight aboard Soyuz-1 to Soyuz-18 are correlated, and preliminary results of Soviet experiments on the joint Apollo Soyuz flight are presented. Aspects of flight support tasks described include biomedical research tasks, crew selection and training, onboard food and water supply, crew work and rest schedules, physiological and hygienic studies, radiation safety, and inflight medical monitoring and prediction. Data on physiological reactions to spaceflight are correlated from preflight, inflight, and postflight studies and examinations, as well as from the results of inflight biological experiments. Some comparisons with the US data are made and discussed. Numerous specific conclusions and areas for future research are presented. Author

N77-21110*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Jan. - Feb. 1977
15 Apr. 1977 226 p refs
(Contract NAS7-100)
(NASA-CR-152647; PR-42-38) Avail: NTIS HC A11/MF A01 CSCL 22D

The various systems and subsystems are discussed for the Deep Space Network (DSN). A description of the DSN is presented along with mission support, program planning, facility engineering, implementation and operations. For individual titles, see N77-21111 through N77-21135.

N77-21111*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Deep Space Network 15 Apr. 1977 p 1-3 (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized. Deep space station, ground communication, and network operations control capabilities are described. Author

N77-21112*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TEST AND TRAINING SYSTEM, MARK III-77 c14
H. C. Thornman *In its* The Deep Space Network 15 Apr. 1977 p 4-15 ref (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

The Mark III-77 system is configured to support DSN testing and training in preparation for the Mariner-Jupiter-Saturn 1977 and Pioneer-Venus 1978 missions, in addition to the on-going in-flight missions. DSN Test and Trailing System capabilities include functions performed in the Deep Space Stations, Ground Communications Facility, and Network Operations Control Center. Author

N77-21113*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK-MARINER JUPITER/SATURN 1977 FLIGHT PROJECT TELECOMMUNICATIONS COMPATIBILITY Summary and Status Report c32
A. I. Bryan, R. P. Kemp, and B. D. Madsen *In its* The Deep Space Network 15 Apr. 1977 p 16-37 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

The DSN-Mariner Jupiter/Saturn 1977 telecommunications compatibility tests conducted during the periods 15-20 November 1976, 7-16 December 1976 and 5 January 1977, are an ongoing series of engineering level tests to determine the flight-ground interface compatibility and performance characteristics between these two systems. Author

N77-21114*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING MISSION SUPPORT c14
D. W. H. Johnston *In its* The Deep Space Network 15 Apr. 1977 p 38-42 (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

The relatively quiet Viking On Board Science & Telemetry period from November 15, 1976, through December 31, 1976, is discussed, when Mars and the Viking spacecraft were in the Solar conjunction period. The period therefore presented the Viking Radio Science Team with a unique opportunity to utilize the DSN and Viking spacecraft to exercise their experiments with nonstandard station configurations, without the usual command and telemetry constraints. Author

N77-21115*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MISSION SUPPORT c14
R. B. Miller *In its* The Deep Space Network 15 Apr. 1977 p 42-49 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

The Ground Data System configuration for support of the Pioneer Venus 1978 Mission is described. Current status of the DSN portion of the Ground Sata System is described. Author

N77-21116*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT c14
P. S. Goodwin, E. S. Burke, and G. M. Rockwell *In its* The Deep Space Network 15 Apr. 1977 p 50-54 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

Activities of the network operations organization are reported in support of the Helios Project during December 1976 and January 1977. Author

N77-21117*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPROVEMENTS IN NAVIGATION RESULTING FROM THE USE OF DUAL SPACECRAFT RADIOMETRIC DATA c17
C. C. Chao, H. L. Siegel, and V. J. Ondrasik *In its* The Deep Space Network 15 Apr. 1977 p 55-65 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 22C

When two interplanetary spacecraft lie along similar geocentric lines-of-sight, navigational advantages may be achieved by navigating one spacecraft with respect to the other. Opportunities to employ this technique will become more common as more multiprobe missions are launched. The two Viking spacecraft and the two Mariner Jupiter/Saturn '77 spacecraft will be within two and three degrees of each other, respectively, for a large portion of their missions. Results of simulated analysis as well as the processing of real tracking data from the two Viking spacecraft reveal the following advantages of the dual spacecraft navigation technique: (1) cancellation of platform parameter and transmission media modeling errors in short arc solutions, (2) accurate encounter guidance for the trailing spacecraft, (3) reduction of total tracking requirements, and (4) rapid determination of the orbit following a maneuver on either spacecraft. Author

N77-21118*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A K-BAND RADIOMETER FOR THE MICROWAVE WEATHER PROJECT c35
K. Wallace, M. Reid, and H. Reilly *In its* The Deep Space Network 15 Apr. 1977 p 66-69 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

The design of a K-band radiometer for use in the microwave weather project is discussed. The major components of the system, such as feedhorn, waveguide switch, and receiver assembly are described. The system will be installed at DSS 13 at Goldstone, California, when completed. Author

N77-21119*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
X-BAND ATMOSPHERIC NOISE TEMPERATURE STATISTICS AT GOLDSTONE DSS 13, 1975 - 1976 c17
S. Slobin, M. Reid, R. Gardner, and D. Cheng *In its* The Deep Space Network 15 Apr. 1977 p 70-76 (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

X-band noise temperature data were taken at Goldstone DSS 13 for the period August 1975 through January 1977. A description of the experiment is given along with probability density functions for zenith noise temperature increase during all year quarters and day quarters. Elevation angle modeling of the data is described along with a discussion of the problems

associated with relating wide beamwidth statistics to narrow beamwidth antennas. Author

N77-21120*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTATION OF SPACECRAFT SIGNAL RAYPATH TRAJECTORIES RELATIVE TO THE SUN **c17**
R. Cannon and C. Stelzried *In its* The Deep Space Network 15 Apr. 1977 p 77-82 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 22C

A computer program (CTS 41B) used to determine the trajectory of a spacecraft signal raypath was updated to increase its usefulness during solar conjunctions (CTS 41C). The closest point of approach of the raypath to the sun is projected onto the surface and the solar latitude and longitude calculated. A sample computation and plots are given for the 1976 Viking solar conjunction. Eventually it may be possible to predict the communication link performance degradation in the near sun region due to solar activity. Author

N77-21121*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF A DISCRETE SPECTRUM ANALYZER FOR THE DETECTION OF RADIO FREQUENCY INTERFERENCE **c32**
B. K. Levitt *In its* The Deep Space Network 15 Apr. 1977 p 83-98 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

As the radio frequency spectrum becomes increasingly overcrowded, interference with mission-critical DSN operations is rising at an alarming rate. To alleviate this problem the DSN is developing a wideband surveillance system for on-site detection and identification of potential sources of radio frequency interference (RFI), which will complement the existing frequency coordination activities. The RFI monitoring system is based on a wideband, multi-look discrete spectrum analyzer operating on fast Fourier transform principles. An extensive general statistical analysis is presented of such spectrum analyzers and derives threshold detection performance formulas for signals of interest. These results are then applied to the design of the RFI spectrum analyzer under development. Author

N77-21122*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A MARKOV MODEL FOR X-BAND ATMOSPHERIC ANTENNA-NOISE TEMPERATURES **c17**
O. H. Adeyemi *In its* The Deep Space Network 15 Apr. 1977 p 99-102 ref (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

A five-state Markov model is suggested for the X-band antenna-noise temperatures based on data collected at Goldstone. The states of the model are determined by changes in the cloud and rain condition of the atmosphere so as to take advantage of the correlation observed between the antenna temperatures and changes in rain rates. Then an indication is given of how to obtain the estimates of the parameters of the model from the data. Author

N77-21123*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SYNCHRONIZATION STRATEGIES FOR RFI CHANNELS **c32**
R. J. McEliece, H. VanTilborg (Calif. Inst. Tech., Pasadena, Calif.), and S. Tung (Cornell Univ., Ithaca, N.Y.) *In its* The Deep Space Network 15 Apr. 1977 p 103-108 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

An RFI channel to be a multiple-access channel is defined in which no sender can know when any other starts, and the problem of determining the relative phases of the senders at the receiver is studied. A new result is proved about binary DEBruijn sequences. Author

N77-21124*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A MAINTENANCE AND OPERATIONS COST MODEL FOR DSN **c83**
R. W. Burt and H. L. Kirkbride *In its* The Deep Space Network 15 Apr. 1977 p 109-114 (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 05C

A cost model for the DSN is developed which is useful in analyzing the 10-year Life Cycle Cost of the Bent Pipe Project. The philosophy behind the development and the use made of a computer data base are detailed; the applicability of this model to other projects is discussed. Author

N77-21125*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ENCODING AND DECODING A TELECOMMUNICATION STANDARD COMMAND CODE **c17**
B. Benjauthrit and T. K. Truong *In its* The Deep Space Network 15 Apr. 1977 p 115-119 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

A simple encoder/decoder implementation scheme is described for the (63,56) BCH code which can be used to correct single errors and to detect any even-number of errors. The scheme is feasible for onboard-spacecraft implementation. Author

N77-21126*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STATUS OF GOLDSTONE SOLAR ENERGY SYSTEM STUDY OF THE FIRST GOLDSTONE ENERGY PROJECT **c44**
F. L. Lansing *In its* The Deep Space Network 15 Apr. 1977 p 120-140 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 10A

The results reached by the DSN engineering section and private consultants in the review of the initial plan of the Golstone Energy Project are summarized. The main objectives were in the areas of energy conservation and the application of solar-driven systems for power and hydrogen generation. This summary will provide background data for management planning decisions both to the DSN engineering section and other organizations planning a similar program. The review showed that an add-on solar driven absorption refrigeration unit with its associated changes to the existing system was not cost-effective, having a payback period of 29 years. Similar economically unattractive results were found for both a solar-hydrogen and a wind-hydrogen generation plant. However, cutting the hydrogen generation linkage from this plant improved its economic feasibility. Author

N77-21127*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS WIND EXPERIMENT RECEIVER **c15**
H. Nishimura *In its* The Deep Space Network 15 Apr. 1977 p 141-147 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 22B

The final design of the Pioneer Venus Wind Experiment Receiver and Phase Calibrator is discussed from the block diagram viewpoint. Measured phase data are shown to derive the predicted performance. The STDN receiver implementation is also discussed. Author

N77-21128*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MULTIPROBE SPACECRAFT SIMULATOR **c15**
S. E. Friedenburg *In its* The Deep Space Network 15 Apr. 1977 p 148-151 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 22B

A test which duplicates the signals of the four probes to be deployed by the PV 78 multiprobe spacecraft was developed. It will be used for receiver operator training prior to the mission. This article describes the operation and characteristics of the test set. Author

N77-21129*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING S-BAND DOPPLER RMS PHASE FLUCTUATIONS USED TO CALIBRATE THE MEAN 1976 EQUATORIAL CORONA **c92**
A. L. Berman and J. A. Wackley *In its* The Deep Space Network 15 Apr. 1977 p 152-166 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

Viking S-band Doppler RMS phase fluctuations (noise) and comparisons of Viking Doppler noise to Viking differenced S-X range measurements are used to construct a mean equatorial electron density model for 1976. Using Pioneer Doppler noise results (at high heliographic latitudes, also from 1976), an equivalent nonequatorial electron density model is approximated. Author

N77-21130*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING DOPPLER NOISE USED TO DETERMINE THE RADIAL DEPENDENCE OF ELECTRON DENSITY IN THE EXTENDED CORONA **c92**
A. L. Berman, J. A. Wackley, S. T. Rockwell, and M. Kwan *In its* The Deep Space Network 15 Apr. 1977 p 167-171 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

The common form for radial dependence of electron density in the extended corona is given. By assuming proportionality between Doppler noise and integrated signal path electron density, Viking Doppler noise can be used to solve for a numerical value of X. Author

N77-21131*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROPORTIONALITY BETWEEN DOPPLER NOISE AND INTEGRATED SIGNAL PATH ELECTRON DENSITY VALIDATED BY DIFFERENCED S-X RANGE **c32**
A. L. Berman *In its* The Deep Space Network 15 Apr. 1977 p 172-183 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

Observations of Viking differenced S-band/X-band (S-X) range are shown to correlate strongly with Viking Doppler noise. A ratio of proportionality between downlink S-band plasma-induced range error and two-way Doppler noise is calculated. A new parameter (similar to the parameter epsilon which defines the ratio of local electron density fluctuations to mean electron density) is defined as a function of observed data sample interval (Tau) where the time-scale of the observations is 15 Tau. This parameter is interpreted to yield the ratio of net observed phase (or electron density) fluctuations to integrated electron density (in RMS meters/meter). Using this parameter and the thin phase-changing screen approximation, a value for the scale size L is calculated. To be consistent with Doppler noise observations, it is seen necessary for L to be proportional to closest approach distance a, and a strong function of the observed data sample interval, and hence the time-scale of the observations. Author

N77-21132*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MODIFICATION OF THE DSN RADIO FREQUENCY ANGULAR TROPOSPHERIC REFRACTION MODEL **c32**
A. L. Berman *In its* The Deep Space Network 15 Apr. 1977 p 184-186 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

The previously derived DSN Radio Frequency Angular Tropospheric Refraction Model contained an assumption which was subsequently seen to be at a variance with the theoretical basis of angular refraction. The modification necessary to correct the model is minor in that the value of a constant is changed. Author

N77-21133*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A MODEL OF SNR DEGRADATION DURING SOLAR CONJUNCTION **c17**
S. T. Rockwell *In its* The Deep Space Network 15 Apr. 1977 p 187-198 (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

The downlink signal from spacecraft in solar conjunction phases suffers a drastic reduction in signal-to-noise ratio (SNR). Responsible in large part for this effect is the increase in system noise temperature (SNT) in the ground antenna-receiver system. An empirical model is presented of SNR degradation due to increasing SNT during solar conjunction phases. Author

N77-21134*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN RESEARCH AND TECHNOLOGY SUPPORT **c14**
E. B. Jackson *In its* The Deep Space Network 15 Apr. 1977 p 199-202 (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

The activities of the Venus Station (DSS 13) and the Microwave Test Facility (MTF) during the period October 11, 1976, through February 13, 1977, are discussed. A significant effort on implementation of equipment for the planned conversion of DSS 13 to unattended operation is discussed. The Receiver and Microwave Subsystem are near completion, and the new feedcone and position encoders are implemented onto the 26-m antenna. Support of the 400-kW X-band radar, located at DSS 14, is reported, and the activities of the DSN High Power Transmitter Maintenance Facility (HPTMF), located at DSS 13 and MTF, are discussed. The successful completion of the first series of observations planned for VLBI validation is reported and significant station maintenance activities are covered. Clock synchronization transmissions to DSS 43 and DSS 63 are reported, and an evaluation of any pointing errors in the 26-m antenna position transducer are made. Author

N77-21135*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COST REDUCTION POTENTIAL OF THE DSN DATA BASE **c60**
M. McKenzie *In its* The Deep Space Network 15 Apr. 1977 p 203-220 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

The cost of the DSN data base can be reduced by computerizing and unifying the current multiplicity of separate manual, computer, and hybrid data bases. Savings would accrue from eliminating all manual system costs, increasing efficiency in data base implementation and maintenance-and-operation, and increasing data accuracy. By applying a simple mathematical savings model to current data base costs, this study estimates the probable range of net ten-year savings. The minimum net savings, under the assumptions of the study, are calculated as $7.5 million. Author

N77-21136*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SOLAR POWER SATELLITE: ANALYSIS OF ALTERNATIVES FOR TRANSPORTING MATERIAL TO GEOSYNCHRONOUS ORBIT
William J. Graff and C. J. Huang 1976 265 p refs Prepared in cooperation with Houston Univ.
(Grant NGT-44-005-114)
(NASA-TM-X-74680) Avail: NTIS HC A12/MF A01 CSCL 22A

A systems design study of the alternative methods and relative merits of various approaches to transporting and assembling a solar power satellite in geosynchronous orbit was conducted. State of the art alternatives for chemical and electrical interorbital propulsion were studied, and several possible scenarios for construction were proposed. Author

N77-21137*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPPORTUNITIES FOR BALLISTIC MISSIONS TO HALLEY'S COMET
Robert W. Farquhar and William H. Wooden, II Mar. 1977 44 p refs
(NASA-TM-X-71289; X-580-77-46) Avail: NTIS HC A02/MF A01 CSCL 22A

Alternative strategies for ballistic missions to Halley's comet in 1985-86 are described. It is shown that a large science return would be acquired from a ballistic Halley intercept in spite of the high flyby speeds of almost 60 km/sec that are associated with this mission mode. The possibility of retargeting the cometary spacecraft to additional comets after the Halley intercept also exists. In one scenario two cometary spacecraft of identical design would be used to carry out four separate cometary encounters over a three-year period. One spacecraft would intercept Halley before its perihelion passage in December 1985 and then go on to comet Borrelly witn an encounter in January 1988. The other spacecraft would be targeted for a post-perihelion Halley intercept in March 1986 before proceeding towards an encounter with comet Tempel-2 in September 1988. The flyby speeds for the Borrelly and Tempel-2 intercepts are 21 and 13 km/sec, respectively. Author

N77-21138# European Space Agency, Paris (France).
EUROPEAN ACTIVITIES IN SPACE MATERIAL SCIENCES AND SPACE PROCESSING
G. Seibert 1976 5 p Presented at the 27th IAF Congr., Anaheim, Calif., 10-16 Oct. 1976
Avail: NTIS HC A02/MF A01

The materials science experiments for inclusion in the first Spacelab flight payload are described. Based on the requirements of typical material sciences experiments, ESA has undertaken a number of equipment studies, like isothermal and gradient furnaces, process chamber, positioning and stirring devices, etc.

A detailed description of these facility studies is given.
Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N77-21139*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF CONTROL HYSTERESIS ON THE SPACE SHUTTLE ORBITER'S ENTRY M.S. Thesis - George Washington Univ.
Richard Wayne Powell Jun. 1975 109 p refs
(NASA-TM-X-74681) Avail: NTIS HC A06/MF A01 CSCL 22C

There are six degree-of-freedom simulations of the space shuttle orbiter entry with aerodynamic control hysteresis conducted on the NASA Langley Research Center interactive simulator known as the Automatic Reentry Flight Dynamics Simulator. These were performed to determine if the presence of aerodynamic control hysteresis would endanger the mission, either by making the vehicle unable to maintain proper attitude for a safe entry, or by increasing the amount of the reaction control system's fuel consumption beyond that carried. Author

N77-21140*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TIDAL PERTURBATIONS ON THE SATELLITE 1967-92A
T. L. Felsentreger, J. G. Marsh, and R. G. Williamson . Feb. 1977 27 p refs Submitted for publication
(NASA-TM-X-71299; X-921-77-22) Avail: NTIS HC A03/MF A01 CSCL 22A

The orbit of the 1967-92A satellite was studied to ascertain the extent to which tidal forces contribute to orbital perturbations. Parameters describing the ocean tide potential-in particular for the M2 and S2 constituents-were estimated. Since the ocean tide potential is less well known than the solid Earth tide, the ocean tide parameter estimation is based upon the use of a value of 0.3 for the solid Earth tide Love number in the orbit determination procedure. These tidal parameter values are in good agreement with those appearing in numerical models of the M2 and S2 tides derived from surface data. Author

N77-21141# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
DESCRIPTION OF THE AIMLASER SATELLITE ORBIT PREDICTION PROGRAM AND ITS IMPLEMENTATION ON THE DELFT UNIVERSITY IBM COMPUTER
B. A. C. Ambrosius, H. J. D. Piersma, and K. F. Wakker May 1976 135 p refs
(VTH-LR-218) Avail: NTIS HC A07/MF A01

The AIMLASER satellite orbit prediction program is described, and a program listing is provided for its implementation on an IBM 370/158. The program was initially run on a CDC 6400 computer, and was obtained from the Smithsonian Astrophysical Observatory. The program accounts for lunar, tesseral, and zonal harmonics perturbation effects. Problems in converting the program are outlined. ESA

N77-21142# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
EFFECT OF REFRACTION CORRECTION OF THE WEILHEIM INTERFEROMETER DATA ON THE ACCURACY OF SATELLITE ORBIT DETERMINATION AND PREDICTION, BASED ON A DATA SAMPLE [DER EINFLUSS DER REFRAKTIONSKORREKTUR DER WEILHEIM--INTERFEROMETER-MESSDATEN AUF DIE GENAUIGKEIT DER SATELLITENBAHNBESTIMMUNG UND -VORHERSAGE, UNTERSUCHT ANHAND EINER DATENSTICHPROBE]
K. Zimmermann 29 Nov. 1976 21 p refs In GERMAN
(DLR-IB-552-76/13) Avail: NTIS HC A02/MF A01

The effect of refraction correction on orbit determination accuracy during a 10 day observation interval, and on the accuracy of prediction using an orbit determination program, was investigated for the Symphonie 1 satellite based on a sample taken from tracking data. It is shown that, although the application of refraction correction produces an improvement of the mean error of single measurements, no improvement of the prediction accuracy is attainable. This result is interpreted using an analysis of the performed estimation method and leads to a number of conclusions for the general evaluation of estimation and sampling methods in the field of orbit analysis. ESA

N77-21143# Royal Aircraft Establishment, Farnborough (England).
THE ORBIT OF PROTON 4 REDETERMINED, WITH GEOPHYSICAL IMPLICATIONS
H. Hiller and D. G. King-Hele Oct. 1976 27 p refs
(RAE-TR-76143; BR55286) Avail: NTIS HC A03/MF A01

The orbit of Proton 4, 1968-103A, has been redetermined, in greater detail and with better accuracy, in order to clarify previously puzzling features in the variation of orbital inclination. Orbital parameters have been determined at 25 epochs between December 1968 and July 1969, using about 1600 optical and radar observations with the RAE orbit refinement program PROP6. During January 1969 the orbit passed through 31:2 resonance. A simultaneous least-squares fitting of theoretical curves to the values of inclination and eccentricity between 14 December 1968 and 6 March 1969 has yielded values for two pairs of lumped 31st-order geopotential coefficients, appropriate to an inclination of 51.5 deg. The 15 values of inclination after the resonance, from March to near decay in July 1969, have been used to determine mean, morning and afternoon-evening values for the rotation rate of the atmosphere at a height near 260 km; the values of rotation rate, namely 1.1, 0.9, and 1.3 rev/day respectively, confirm the trends already established from analysis of other satellite orbits. Author (ESA)

N77-21144 Accession number not used.

N77-21145# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
PRIMARY SATELLITE ORBIT DETERMINATION FROM LAPLACE ANGULAR MEASUREMENTS [ERSTBAHNBESTIMMUNG VON SATELLITEN AUS WINKELMESSUNGEN NACH LAPLACE]
G. Toepfer 23 Nov. 1976 25 p refs In GERMAN
(DLR-IB-552-76/16) Avail: NTIS HC A02/MF A01

The application of the classical boundary value problem (according to the Laplace principle) to primary orbit determination was investigated. Celestial bodies and satellites have in common that their motion is along conical orbits around a central mass. The additional problems for earth satellites is that the topocenter (observation station) does not move according to a conical trajectory. Methods were developed based on certain orbital hypotheses to solve the problem as a boundary value problem. Programs were produced for testing the proposed method for three given satellite orbits; results are reported. ESA

N77-21146# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
STATIONKEEPING OF GEOSTATIONARY SATELLITES [ZUR POSITIONSHALTUNG GEOSTATIONAERER SATELLITEN]
M. C. Eckstein 25 Nov. 1976 20 p refs In GERMAN; ENGLISH summary
(DLR-IB-552-76/17) Avail: NTIS HC A02/MF A01

An iterative method is described for determining the impulses and the times of the impulses which are needed to effect a prescribed orbit change for the case where the propulsion system orientation is given. The method makes use of an existing computer program and is demonstrated by two examples. Author (ESA)

N77-21147# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
THE ORBITAL ELEMENTS OF GEOSTATIONARY ORBIT
E. F. Jochim [1977] 24 p refs In GERMAN; ENGLISH summary
(DLR-IB-552-77/1) Avail: NTIS HC A02/MF A01

Several different methods of calculating, respectively, the geostationary radius and the semi-major axis of the geostationary orbit are presented. Considering only first order perturbations due solely to J2, the geostationary orbit turns out to be a circle where the position of the satellite is always at the perigee of an osculating ellipse which rotates with the angular velocity of the earth's rotation. The Keplerian elements of the osculating ellipse were calculated. Author (ESA)

N77-21148# Royal Aircraft Establishment, Farnborough (England).
THE ELLIPTIC ORBIT INTEGRATION PROGRAM POINT
G. E. Cook and M. D. Palmer Sep. 1976 96 p refs
(RAE-TR-76129; BR55559) Avail: NTIS HC A05/MF A01

POINT is a computer program which evaluates the development of an earth satellite orbit by numerical integration. Provision is made for the inclusion of the following perturbations: earth's gravitational potential, atmospheric drag, and the gravitational attractions of the sun and moon. A detailed description of the program is given, with full instructions for its use. Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N77-21111*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Apr. 1977 p 1-3 (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

N77-21112*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TEST AND TRAINING SYSTEM, MARK III-77
H. C. Thornman *In its* The Deep Space Network 15 Apr. 1977 p 4-15 ref (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

N77-21114*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING MISSION SUPPORT
D. W. H. Johnston *In its* The Deep Space Network 15 Apr. 1977 p 38-42 (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

N77-21115*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MISSION SUPPORT
R. B. Miller *In its* The Deep Space Network 15 Apr. 1977 p 42-49 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

N77-21116*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT
P. S. Goodwin, E. S. Burke, and G. M. Rockwell *In its* The Deep Space Network 15 Apr. 1977 p 50-54 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

N77-21134*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN RESEARCH AND TECHNOLOGY SUPPORT
E. B. Jackson *In its* The Deep Space Network 15 Apr. 1977 p 199-202 (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N77-21149# Saad Publications, Karachi (Pakistan).
RESEARCH OF THE UPPER-ATMOSPHERE: FIRST ROCKET EXPERIMENTS IN THE USSR
B. A. Mirtov and L. A. Vedeshin 1976 11 p refs Repr. from IAF (USSR), 1975 p 1-6 Transl. into ENGLISH from Russian report Sponsored by Smithsonian Institution and NSF
(TT-76-53470) Avail: NTIS HC A02/MF A01

The first Soviet rockets were used for gauging of atmospheric pressure and sampling of air, providing a lot of information regarding the upper atmospheric layers. Besides the research of the upper atmosphere and ionosphere, the rockets also served as a basis for solving a number of applied problems, connected with perfecting the cosmic rocket technique. Author

N77-21150# Saad Publications, Karachi (Pakistan).
DEVELOPMENT OF THE FIRST AUTOMATIC SPACE STATIONS FOR LUNAR FLIGHT BY THE USSR
G. Yu. Maximov and Yu. A. Matusevich 1976 17 p refs Transl. into ENGLISH from IAF, 1975 p 1-12 Prepared for the Smithsonian Institution and NSF
(TT-76-53471) Avail: NTIS HC A02/MF A01

Further development of the space technique confirmed the correctness of the main principles in the construction of the automatic station Luna-3. In particular: solar batteries, as power generators were included on the board equipment of the spacecraft of various purpose; the relay systems of orientation control are more widely used in the research of remote space; and the two-stage operation procedure of the orientation control system, developed for the Luna-3, is at present generally adopted in the practice of space flights. Author

N77-21151*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORBIT DETERMINATION WITH THE TRACKING DATA RELAY SATELLITE SYSTEM
P. Argentiero and F. Loveless (Old Dominion Systems, Inc.) Feb. 1977 29 p refs Submitted for publication
(NASA-TM-X-71280; X-932-76-185) Avail: NTIS HC A03/MF A01 CSCL 22A

The possibility of employing the tracking data relay satellite system to satisfy the orbit determination demands of future applications missions is investigated. It is shown that when the relay satellites are continuously and independently tracked from ground stations it is possible, using six hour data arcs, to recover user satellite state with an average error of about 25 m radially, 260 m along track, and 20 m cross track. For this arc length, range sum data and range sum rate data are equally useful in determining orbits. For shorter arc lengths (20 min), range sum rate data is more useful than range sum data. When relay satellites are not continuously tracked, user satellite state can be recovered with an average error of about 140 m radially, 515 m along track, and 110 m cross track. These results indicate that the TDRS system can be employed to satisfy the orbit determination demands of applications missions, such as the MAGSAT and potential gradiometer missions, provided the relay satellites are continuously and independently tracked. Author

N77-21152* National Aeronautics and Space Administration, Washington, D. C.
DELTA LAUNCH-ESA/GEOS MISSION
5 Apr. 1977 19 p
(NASA-TM-X-74609; M-492-302-77-01) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

The terms and conditions whereby NASA will furnish Delta launch vehicles and associated services on a reimbursable basis for the purpose of launching the scientific geostationary satellite called ESA/GEOS are stipulated. Author

N77-21153*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SATELLITE SITUATION REPORT, VOLUME 17, NO. 1
28 Feb. 1977 40 p
(NASA-TM-X-74683) Avail: NTIS HC A03/MF A01 CSCL 05B

Space objects in orbit as well as those which decayed during the reporting period are listed. Data provided include international designation and catalog number, nation of source, launch date, and inclination, apogee and perigee. Transmitting frequencies for satellites being monitored by NASA space flight tracking and data network are given. A.R.H.

N77-21154# Centre National d'Etudes Spatiales, Toulouse (France).
DATA PROCESSING FOR ATTITUDE STABILIZATION OF THE D2B SATELLITE [LES TRAITEMENTS DE RESTITUTION D'ATTITUDE DU SATELLITE D2B]
Jean-Marie Robert Aug. 1976 52 p refs In FRENCH; ENGLISH summary
(CNES-NT-43) Avail: NTIS HC A04/MF A01

The attitude stabilization of the D2B satellite is fundamental for the processing of all the scientific experiments. It has been necessary to develop programs using new methods better adapted to the various problems which are encountered. Three programs fulfill the following functions: the first is used in real time to compute the rotation vector components on the satellite axis (p, q, r), the second gives the attitude by a simple method (it is used for immediate visual treatment), and the third computes the attitude by a refined method using solar data during the day or the star field locating experiment during the night. These programs are described as regards both the method and the results. Author (ESA)

N77-21155# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
SPACELAB - SUBSATELLITE OF THE DFVLR (DEFINITION) [SPACELAB - SUBSATELLIT DER DFVLR (DEFINITION)]
L. Liebing and J. Puls Feb. 1975 23 p refs In GERMAN
(DLR-IB-552-75/22) Avail: NTIS HC A02/MF A01

A subsatellite program is proposed in combination with Spacelab. This subsatellite is modular with a view to cost effectiveness and flexibility for the user and will be launched from Spacelab. During the Spacelab mission, the satellite will point at earth as well as Spacelab. Its distance from Spacelab will be 2000 km; after termination of the Spacelab mission the satellite will be transferred to an orbit over 500 km in order to guarantee a life of at least two years for long duration experiments. A relatively small propulsion unit will be sufficient for these maneuvers. ESA

N77-21156# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
ORBIT AND CONFIGURATION OF A SUN AND EARTH OBSERVATION METEOROLOGICAL SATELLITE (POMS) [AUSLEGUNG DER BAHN UND DER KONFIGURATION EINES SONNEN- UND ERDBEOBACHTENDEN METEOROLOGISCHEN SATELLITEN (POMS)]
A. Pietrass 3 Aug. 1976 41 p refs In GERMAN
(DLR-IB-552-76/4) Avail: NTIS HC A03/MF A01

The design of a sun and earth observation satellite for measurement of the atmospheric radiation budget is developed stepwise. A new satellite configuration is proposed, and the orbit is selected. ESA

N77-21157# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
THEORETICAL STUDY OF THE EFFECT OF ATMOSPHERIC REFRACTION CORRECTION ON ORBIT DETERMINATION ACCURACY OF SYMPHONIE IN GEOSTATIONARY ORBIT [THEORETISCHE UNTERSUCHUNG DES EINFLUSSES DER ATMOSPHAERENREFRAKTIONS-KORREKTUR AUF DIE BAHNBESTIMMUNGSGENAUIGKEITENAUIGKEIT VON SYMPHONIE IM GEOSTATIONAEREN ORBIT]
A. Leibold 18 Nov. 1976 15 p refs In GERMAN
(DLR-IB-552-76/7) Avail: NTIS HC A02/MF A01

An error analysis program was used to determine the effect of atmospheric refraction correction on the orbit determination accuracy of the Symphonie satellite. It is found that the refraction correction has a unique effect on the determination of satellite length, irrespective of tracking strategy. The effect on other orbital elements depends on tracking strategy. ESA

N77-21158# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
SIMULATION OF AN ATTITUDE CONTROL SYSTEM WITH STAGGERED PULSES ON THE SATELLITE MOTION SIMULATOR OF DFVLR Final Report [SIMULATIONSTESTS EINES LAGEREGELUNGSSYSTEMS MIT GESTAFFELTEN IMPULSEN AUF DEM SATELLITENBEWEGUNGSSIMULATOR DER DFVLR]
R. Stapf and K. Becker (ERNO, Bremen) Jul. 1976 81 p refs In GERMAN; ENGLISH summary
(Contract RV-11-B-7/74-TL-BB-73)
(DLR-IB-552-76/11) Avail: NTIS HC A05/MF A01

The attitude control system with staggered pulses was tested in a pysical simulation on a three-axis air bearing table using original sensors and cold-gas thrusters. The objectives of the simulations were a test of system behavior under real conditions, the search and analysis of critical modes, and a determination of the limits of the system. The description of the system and the experimental setup is followed by a presentation of the results which shows that the system is suitable for coarse attitude-control as well as for attitude control in the range of arcseconds. Author (ESA)

N77-21159# Naval Research Lab., Washington, D. C.
WAVEGUIDE-MODE POWER BUDGET FOR AN ELF/VLF TRANSMITTING SATELLITE Final Report
F. J. Kelly, G. A. Chayt, and D. J. Baker 17 Sep. 1976 27 p refs
(RF21222402)
(AD-A032287; NRL-8032) Avail: NTIS HC A03/MF A01 CSCL 20/14

Signal-to-noise (S/N) ratio power budgets are evaluated for an ELF/VLF transmitting satellite using waveguide-mode field representations in the frequency range from 250 Hz to 9 kHz and for satellite heights from 120 km to 800 km. The low-order waveguide-mode parameters are presented. The propagation of the waveguide-mode fields into the lower ionosphere is evaluated using a full wave method. The propagation of the fields in the upper ionosphere is evaluated by a ray-tracing method. When these fields are known, the propagation from a ground-based transmitter to a satellite receiver may be evaluated, as well as the reciprocal transmission from a satellite transmitter to a ground-based receiver. The radiation resistance of a finite loop magnetic dipole antenna is evaluated for a variety of frequencies and locations in the ionosphere for both open and closed index of refraction surfaces. The satellite power required to provide a S/N ratio in excess of 0 dB in a 1-Hz bandwidth at a 1-Hertz bandwidth at a ground range of 1 Mm from the ionospheric exit point of the waves is evaluated for several cases. The power requirements (in the megawatt range) exceed the power supplied on current spacecraft missions, but they are within the realm considered possible for future space electric power systems. GRA

N77-21160# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
A RADIATING UHF SATELLITE SIMULATOR Final Technical Report, Oct. 1973 - Jun. 1976
James J. Foshee Jul. 1976 35 p refs
(AD-A031568; AFAL-TR-76-174) Avail: NTIS HC A03/MF A01 CSCL 22/2

This technical report contains a description of a Radiating UHF Satellite Simulator. This Radiating Simulator is a simplified version of the FLEETSATCOM satellite and was designed to augment the flight test program of the Air Force Satellite Communications System (AFSCS). Author (GRA)

N77-21161# Defense Communications Engineering Center, Reston, Va.
SATELLITE TRENDS AND DEFENSE COMMUNICATIONS
N. Abramson Jun. 1976 29 p refs

(AD-A032288; TN-20-76) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report examines some of the long term trends in the economics of satellite communications networks and how these trends are reflected in the architecture of these networks. These trends are examined using data obtained from the INTELSAT series of commercial communications satellites, and their effects on military satellite networks are also indicated. GRA

N77-21162# Ohio State Univ., Columbus. Electroscience Lab.

MULTIFUNCTION TDMA TECHNIQUES Final Technical Report, Jan. 1972 - Jun. 1975

R. Caldecott Aug. 1976 31 p refs

(Contract F30602-72-C-0162)

(AD-A031482; ESL-3364-7; RADC-TR-76-225) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report presents a background discussion and general overview of the design of prototype equipment fabricated to demonstrate the feasibility of TDMA systems. Problems and options associated with the design of the equipment consisting of prototype TDMA modems and a satellite simulator which employs an adaptive null-steering array (ANSA) are presented in varying degrees of detail. Also, potential applications are identified and discussed briefly. As a result of the work performed during this contract it has been possible to definitely establish that TDMA and ANSA techniques are practical means for improving the efficiency and capability of satellite relay communications systems. Author (GRA)

N77-21163# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Guidance and Control Directorate.

THAD T-7 MISSILE MONTE-CARLO TERMINAL HOMING SIMULATION UTILIZING ALS, DIGITAL/LINEAR AND TV SEEKERS

Charles L. Lewis, William R. Hooker, Abner W. Lee, Jr. (Computer Sciences Corp., Huntsville, Ala.), and Jay Scott Harrison (Computer Sciences Corp., Huntsville, Ala.) 1 Jul. 1976 605 p refs

(AD-A032048; RG-7T-2) Avail: NTIS HC A99/MF A01 CSCL 16/4

The all-digital, Monte Carlo six degree of freedom simulation program documented in this report provides a realistic method for the evaluation and analysis of a terminal homing weapons system. Included is a functional overview of the program, a detailed description of the individual modules and subroutines, a brief description (where appropriate) of the components modeled, and a guide to the use of the program. The missile modeled in the program is the 7-in. HORNET airframe utilized as the basic flight test bed by the U.S. Army Missile Command's Terminal Homing Accuracy Demonstration group. Two gimballed seekers are modeled which null on the line-of-sight vector to provide an initial signal for proportional navigation guidance. GRA

N77-21164# Auburn Univ., Ala. Engineering Experiment Station.

THE ANALYTICAL ANALYSIS OF A SINGLE POINT SUSPENSION TECHNIQUE FOR PREDICTING MISSILE THRUST MALALIGNMENT Final Report, 1 Oct. 1975 - 30 Sep. 1976

John A. Schaeffel, Jr. and Joe W. Reece Aug. 1976 77 p refs

(Grant DAAG29-76-G-0060)

(AD-A032066; ARO-13651.1-AE) Avail: NTIS HC A05/MF A01 CSCL 16/4

The lateral perturbing forces due to thrust malalignment can significantly affect the flight characteristics of a missile. Past attempts to predict thrust malalignment have not proven successful. This report proposes a new method for making valid measurements of the malalignment phenomena through the use of a single point tethered missile technique. The equations of motion for the missile in the test device are developed, coded into a computer and tested against well known exact analytical solutions for motion about a point. The mass, inertia and thrust equations for a typical test missile are then coded into the computer and the resultant motion paths are simulated for various initial spin rates and degrees of thrust malalignment. Analysis of the collected data indicates that the tethered technique is a viable solution for predicting thrust malalignment. Author (GRA)

N77-21165# Defense Communications Engineering Center, Reston, Va.

AN ADVANCED CONCEPT FOR THE OVERSEAS DCS

B. J. Leon Aug. 1976 35 p refs

(AD-A033556; TN-18-76) Avail: NTIS HC A03/MF A01 CSCL 17/2

A digital, time-division-multiplex, multiple access system with primary communications via satellite is proposed for the overseas DCS. This proposed system could be built with current technology except for the space shuttle needed for launching, would require only four satellites, and would have sufficient capacity for the foreseeable future. Author (GRA)

N77-21166# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

PRIVATE LINE INTERFACE DEVELOPMENT. PACKET NETWORK SECURITY Combined Quarterly Technical Report

R. D. Bressler Nov. 1976 38 p

(Contracts MDA903-76-C-0213; MDA903-76-C-0214; MDA903-76-C-0252; ARPA Order 3173; ARPA Order 3186; ARPA Order 3214)

(AD-A033352; BBN-3458; QTR-3) Avail: NTIS HC A03/MF A01 CSCL 17/2

This Quarterly Technical Report describes work on the development of a Private Line Interface, on end-to-end packet network security, and on the development of and experimentation with packet broadcast by satellite. Author (GRA)

N77-21127*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

PIONEER VENUS WIND EXPERIMENT RECEIVER

H. Nishimura *In its* The Deep Space Network 15 Apr. 1977 p 141-147 refs (For primary document see N77-21110 12-12)

Avail: NTIS HC A11/MF A01 CSCL 22B

N77-21128*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

PIONEER VENUS 1978 MULTIPROBE SPACECRAFT SIMULATOR

S. E. Friedenburg *In its* The Deep Space Network 15 Apr. 1977 p 148-151 refs (For primary document see N77-21110 12-12)

Avail: NTIS HC A11/MF A01 CSCL 22B

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N77-21167*# Chrysler Corp., New Orleans, La. Space Div.

HEAT-TRANSFER TEST RESULTS FOR A .0275-SCALE SPACE SHUTTLE EXTERNAL TANK WITH A 10 DEG/40 DEG DOUBLE CONE-OGIVE NOSE IN THE NASA/AMES 3.5-FOOT HYPERSONIC WIND TUNNEL (FH14), VOLUME 2

Harry R. Carroll (Martin Marietta Corp., New Orleans) Feb. 1977 872 p refs

(Contract NAS9-13247)

(NASA-CR-151042; DMS-DR-2313-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 20D

A .0275 scale forebody model of the new baseline configuration of the space shuttle external tank vent cap configuration was tested to determine the flow field due to the double cone configuration. The tests were conducted in a 3.5 foot hypersonic wind tunnel at alpha = -5 deg, -4.59 deg, 0 deg, 5 deg, and 10 deg; beta = 0 deg, -3 deg, -5.51 deg, -6 deg, -9 deg, and +6 deg; nominal freestream Reynolds numbers per foot of 1.5 x 1 million, 3.0 x 1 million, and 5.0 x 1 million; and a nominal Mach number of 5. Separation and reattached flow from thermocouple data, shadowgraphs, and oil flows indicate that separation begins about 80% from the tip of the 10 deg cone, then reattaches on the vent cap and produces fully turbulent flow over most of the model forebody. The hardware disturbs

the flow over a much larger area than present TPS application has assumed. A correction to the flow disturbance was experimentally suggested from the results of an additional test run. Author

N77-21168*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
DATA PROCESSING SYSTEM AND INTERFACING ELEMENTS TIME BASE ANALYSIS
J. D. Blackburn 21 Mar. 1977 20 p refs
(Contract NAS9-14960)
(NASA-CR-151238; DN-1.3-C0613-001) Avail: NTIS HC A02/MF A01 CSCL 09B

The processing of time in the Orbiter System Services software and the associated facilities provided to the user community are described. The descriptions are directed toward showing the functional intent of the design rather than the actual implementation. Simplified flow diagrams are included. Based upon detailed analysis of a preliminary review copy of the Approach and Landing Test (ALT) System Software Detailed Design Specification and the Program Listings for Version 17 Prime, the processing of time has the potential for error free operations. The processing of time is not expected to change between ALT and the Operational Flight Test (OFT) other than differences in value of some constants for control and limit checking. Due to the dynamic nature of onboard time processing and its criticality to the successful operation of the orbiter, it is recommended that a comprehensive list of external variables, their locations, initial values, and a 'where used' listing be produced, as a by-product of the link edit process, for all non-HAL coding. In addition, a careful review of the verification test procedures for the System Services time-related software is recommended. Author

N77-21169*# Chrysler Corp., New Orleans, La. Michoud Defense-Space Div.
RESULTS OF AN INVESTIGATION OF THE SPACE SHUTTLE INTEGRATED VEHICLE AERODYNAMIC HEATING CHARACTERISTICS OBTAINED USING THE 0.0175-SCALE MODEL 60-OTS IN AEDC TUNNEL A DURING TESTS IH41 AND IH41A
J. W. Cummings (Rockwell Intern., Downey, Calif.) and W. H. Dye (Rockwell Intern., Downey, Calif.) Feb. 1977 853 p refs
(Contract NAS9-13247)
(NASA-CR-151054; DMS-DR-2240) Avail: NTIS HC A99/MF A01 CSCL 01A

A thin skin thermocouple test was conducted to obtain heat-transfer data on the space shuttle integrated vehicle during the ascent phase of the flight profile. The test model was the 0.0175-scale thin skin thermocouple model (60-OTS) of the Rockwell International vehicle 5 configuration. The test was conducted at nominal Mach numbers of 2.5, 3.5, 4.5, and 5.5, and a free stream unit Reynolds number of 5 million per ft. Heat transfer data were obtained for angles of attack of 0, + or - 5, and 10 deg and yaw angles of 0, 3, and 6 deg. The integrated vehicle model was tested with the external tank configured with both a smooth ogive nose and an ogive nose with a spherical nose tip (nipple nose). The remainder of the test was conducted with the external tank installed alone in the tunnel. Author

N77-21170*# Chrysler Corp., New Orleans, La. Michoud Defense-Space Div.
RESULTS OF PHASE CHANGE HEAT TRANSFER TEST OH51 USING 0.006-SCALE SPACE SHUTTLE ORBITER MODELS 46-0 AND 90-0 AND PARTIAL WING 0.0175-SCALE MODEL 64-0 IN THE LARC 31-INCH CFHT
J. W. Cummings (Rockwell Intern., Downey, Calif.) Mar. 1977 40 p refs
(Contract NAS9-13247)
(NASA-CR-151058; DMS-DR-2368) Avail: NTIS HC A03/MF A01 CSCL 01A

Test OH51 was a phase change paint test conducted in the LaRC 31-inch CFHT utilizing models 46-0, 64-0, and 90-0. Model 46-0 represented the space shuttle configuration 139 Orbiter. Model 90-0 represented the configuration 140 Orbiter. Model 64-0 represented the forward 45% portion of the Orbiter wing. The partial wing was tested with a shock generator located at various positions relative to the wing. The test was conducted at Mach 10.0, angles of attack from 27.5 deg through 37.5 deg, and Reynolds numbers of 0.5 and 1.5 million per foot. Author

N77-21171*# Axiomatix, Marina del Rey, Calif.
STUDY TO INVESTIGATE AND EVALUATE MEANS OF OPTIMIZING THE KU-BAND COMMUNICATION FUNCTION FOR THE SPACE SHUTTLE Final Report
Marvin K. Simon, Sergei Udalov, and Gaylord K. Huth 31 Mar. 1976 218 p refs
(Contract NAS9-14614)
(NASA-CR-151254; R7703-2) Avail: NTIS HC A10/MF A01 CSCL 17B

The forward link of the overall Ku-band communication system consists of the ground- TDRS-orbiter communication path. Because the last segment of the link is directed towards a relatively low orbiting shuttle, a PN code is used to reduce the spectral density. A method is presented for incorporating code acquisition and tracking functions into the orbiter's Ku-band receiver. Optimization of a three channel multiplexing technique is described. The importance of Costas loop parameters to provide false lock immunity for the receiver, and the advantage of using a sinusoidal subcarrier waveform, rather than square wave, are discussed. Author

N77-21172*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
SPACE SHUTTLE ENGINEERING AND OPERATIONS SUPPORT. SEPARATION OPERATIONAL LIMITS FOR ALT FREE FLIGHTS 1 THROUGH 5
R. H. Seale 31 Mar. 1977 22 p refs
(Contract NAS9-14960)
(NASA-CR-151287; DN-1.4-7-50) Avail: NTIS HC A02/MF A01 CSCL 22A

The orbiter/SCA separation operational limits for the current target conditions of ALT free flights 1 through 5 are analyzed. The separation operational limits are used to verify that no separation design constraints are violated. The operational limits represent the acceptable dispersions in attainment of separation target conditions which assure safe separation. Safe separation is based on satisfying all specified separation design criteria except orbiter altitude at ALT interface airspeed. Separation operational limits are defined for each of the five orbiter tailcones on ALT free flight missions based upon preflight aerodynamics. The effect of carrier pilot steering compensation due to off-nominal flight conditions is determined to be within the separation operational limits. Author

N77-21173*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
SPACE SHUTTLE ENGINEERING AND OPERATIONS SUPPORT. ALT SEPARATION REFERENCE TRAJECTORIES FOR TAILCONE ON ORBITER FORWARD AND AFT CG CONFIGURATIONS. MISSION PLANNING, MISSION ANALYSIS AND SOFTWARE FORMULATION
G. M. Glenn 31 Mar. 1977 87 p refs
(Contract NAS9-14960)
(NASA-CR-151288; DN-1.4-7-53) Avail: NTIS HC A05/MF A01 CSCL 22A

A preflight analysis of the ALT separation reference trajectories for the tailcone on, forward, and aft cg orbiter configurations is documented. The ALT separation reference trajectories encompass the time from physical separation of the orbiter from the carrier to orbiter attainment of the maximum ALT interface airspeed. The trajectories include post separation roll maneuvers by both vehicles and are generated using the final preflight data base. The trajectories so generated satisfy all known separation design criteria and violate no known constraints. The requirement for this analysis is given along with the specifications, assumptions, and analytical approach used to generate the separation trajectories. The results of the analytical approach are evaluated, and conclusions and recommendations are summarized. Author

N77-21174*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
QUICK LOOK ANALYSIS OF AN EMERGENCY SEPARATION FOR ALT CAPTIVE-INERT FLIGHT 1
G. M. Glenn and R. H. Seale 31 Mar. 1977 34 p refs
(Contract NAS9-14960)

(NASA-CR-151289; DN-1.4-7-52) Avail: NTIS HC A03/MF A01 CSCL 22A

Emergency separation capability for the landing configuration of ALT Captive Inert Flight Number One was investigated. The quick look analysis confirms emergency separation capability under nominal conditions for the ALT landing configuration. The recommended emergency separation procedure under those conditions is not applicable to all ALT configurations. Author

N77-21175*# Chrysler Corp., New Orleans, La.
RESULTS OF FLUTTER TEST OS7 OBTAINED USING THE 0.14-SCALE SPACE SHUTTLE ORBITER FIN/RUDDER MODEL NUMBER 55-0 IN THE NASA LaRC 16-FOOT TRANSONIC DYNAMICS WIND TUNNEL
C. L. Berthold (Rockwell Intern., Downey, Calif.) Mar. 1977 57 p refs
(Contract NAS9-13247)
(NASA-CR-151057; DMS-DR-2363) Avail: NTIS HC A04/MF A01 CSCL 01A

A 0.14-scale dynamically scaled model of the space shuttle orbiter vertical tail was tested in a 16-foot transonic dynamic wind tunnel to determine flutter, buffet, and rudder buzz boundaries. Mach numbers between .5 and 1.11 were investigated. Rockwell shuttle model 55-0 was used for this investigation. A description of the test procedure, hardware, and results of this test is presented. Author

N77-21176*# Techno-Sciences, Inc., Annapolis, Md.
DATA PROCESSING/DISPLAY DESIGN FOR THE SPACE SHUTTLE/SPACELAB ELECTROMAGNETIC ENVIRONMENT EXPERIMENT (EEE) Final Report, Jul. 1975 - Aug. 1976
L. D. Davisson Aug. 1976 61 p
(Contract NAS5-22458)
(NASA-CR-152485; TSI-76120) Avail: NTIS HC A04/MF A01 CSCL 14B

Methods for data analysis, data compression including universal coding, storage and retrieval on random access storage devices, and display were developed and implemented on the GSFC Interdata computer. The original 64 bit per frequency band representation was reduced to 10 bits through source coding/universal coding, a compression ratio of 6.4, prior to storage. Rapid encoding/decoding was achieved by the algorithms used so that rapid random access is retained. Author

N77-21177*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF FLUTTER TEST OS6 OBTAINED USING THE 0.14-SCALE WING/ELEVON MODEL (54-0) IN THE NASA LaRC 16-FOOT TRANSONIC DYNAMICS WIND TUNNEL
C. L. Berthold (Rockwell Intern., Downey, Calif.) Mar. 1977 58 p refs Prepared in cooperation with Grumman Aerospace Corp., Bethpage, New York
(Contract NAS9-13247)
(NASA-CR-151056; DMS-DR-2365) Avail: NTIS HC A04/MF A01 CSCL 01A

A 0.14-scale dynamically scaled model of the space shuttle orbiter wing was tested in the Langley Research Center 16-Foot Transonic Dynamics Wind Tunnel to determine flutter, buffet, and elevon buzz boundaries. Mach numbers between 0.3 and 1.1 were investigated. Rockwell shuttle model 54-0 was utilized for this investigation. A description of the test procedure, hardware, and results of this test is presented. Author

N77-21178*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF PHASE CHANGE PAINT THERMAL MAPPING TEST OH46 USING THE 0.006-SCALE MODEL 90-0 IN THE NASA LaRC VARIABLE DENSITY TUNNEL
J. W. Cummings (Rockwell Intern., Downey, Calif.) and W. H. Dye (Rockwell Intern., Downey, Calif.) Mar. 1977 277 p ref
(Contract NAS9-13247)
(NASA-CR-151065; DMS-DR-2350) Avail: NTIS HC A13/MF A01 CSCL 20D

Results of a test conducted in the NASA LaRC Mach 8 variable density tunnel to obtain thermal contours on a 0.006 scale model of the configuration 140B Space Shuttle Orbiter are presented using the phase change paint technique. The model was tested at 25 deg, 30 deg, and 35 deg angle of attack at unit Reynolds numbers ranging from 1.0 through 8.0 million per foot. The model was tested with and without a ventral fin mounted on its bottom centerline. Elevon deflections of 0 deg and 10 deg and bodyflap deflections of 0 and 13.75 deg were investigated. Author

N77-21179*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
INTEGRATED PAYLOAD AND MISSION PLANNING, PHASE 3. VOLUME 1: INTEGRATED PAYLOAD AND MISSION PLANNING PROCESS EVALUATION Final Report
T. P. Sapp and D. E. Davin 31 Mar. 1977 234 p
(Contract NAS8-31146)
(NASA-CR-150231; MDC-G6741-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 22A

The integrated payload and mission planning process for STS payloads was defined, and discrete tasks which evaluate performance and support initial implementation of this process were conducted. The scope of activity was limited to NASA and NASA-related payload missions only. The integrated payload and mission planning process was defined in detail, including all related interfaces and scheduling requirements. Related to the payload mission planning process, a methodology for assessing early Spacelab mission manager assignment schedules was defined. Author

N77-21180*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
INTEGRATED PAYLOAD AND MISSION PLANNING, PHASE 3. VOLUME 2: LOGIC/METHODOLOGY FOR PRELIMINARY GROUPING OF SPACELAB AND MIXED CARGO PAYLOADS Final Report
T. E. Rodgers and J. F. Johnson 31 Mar. 1977 158 p 4 Vol.
(Contract NAS8-31146)
(NASA-CR-150232; MDC-G6741-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 22A

The logic and methodology for a preliminary grouping of Spacelab and mixed-cargo payloads is proposed in a form that can be readily coded into a computer program by NASA. The logic developed for this preliminary cargo grouping analysis is summarized. Principal input data include the NASA Payload Model, payload descriptive data, Orbiter and Spacelab capabilities, and NASA guidelines and constraints. The first step in the process is a launch interval selection in which the time interval for payload grouping is identified. Logic flow steps are then taken to group payloads and define flight configurations based on criteria that includes dedication, volume, area, orbital parameters, pointing, g-level, mass, center of gravity, energy, power, and crew time. Author

N77-21181*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
INTEGRATED PAYLOAD AND MISSION PLANNING, PHASE 3. VOLUME 3: GROUND REAL-TIME MISSION OPERATIONS Final Report
W. J. White 31 Mar. 1977 242 p refs 4 Vol.
(Contract NAS8-31146)
(NASA-CR-150233; MDC-G6741-Vol-3) Avail: NTIS HC A11/MF A01 CSCL 22A

The payloads tentatively planned to fly on the first two Spacelab missions were analyzed to examine the cost relationships of providing mission operations support from onboard vs the ground-based Payload Operations Control Center (POCC). The quantitative results indicate that use of a POCC, with data processing capability, to support real-time mission operations is the most cost effective case. Author

N77-21182*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
INTEGRATED PAYLOAD AND MISSION PLANNING, PHASE 3. VOLUME 4: OPTIMUM UTILIZATION OF SPACELAB RACKS AND PALLETS Final Report
R. G. Logston and G. D. Budris 31 Mar. 1977 90 p ref
(Contract NAS8-31146)
(NASA-CR-150234; MDC-G6741-Vol-4) Avail: NTIS HC A05/MF A01 CSCL 22A

The methodology to optimize the utilization of Spacelab racks

and pallets and to apply this methodology to the early STS Spacelab missions was developed. A review was made of Spacelab Program requirements and flow plans, generic flow plans for racks and pallets were examined, and the principal optimization criteria and methodology were established. Interactions between schedule, inventory, and key optimization factors; schedule and cost sensitivity to optional approaches; and the development of tradeoff methodology were addressed. This methodology was then applied to early spacelab missions (1980-1982). Rack and pallet requirements and duty cycles were defined, a utilization assessment was made, and several trade studies performed involving varying degrees of Level IV integration, inventory level, and shared versus dedicated Spacelab racks and pallets. Author

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N77-21117*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPROVEMENTS IN NAVIGATION RESULTING FROM THE USE OF DUAL SPACECRAFT RADIOMETRIC DATA
C. C. Chao, H. L. Siegel, and V. J. Ondrasik *In its* The Deep Space Network 15 Apr. 1977 p 55-65 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 22C

N77-21119*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
X-BAND ATMOSPHERIC NOISE TEMPERATURE STATISTICS AT GOLDSTONE DSS 13, 1975 - 1976
S. Slobin, M. Reid, R. Gardner, and D. Cheng *In its* The Deep Space Network 15 Apr. 1977 p 70-76 (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

N77-21120*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTATION OF SPACECRAFT SIGNAL RAYPATH TRAJECTORIES RELATIVE TO THE SUN
R. Cannon and C. Stelzried *In its* The Deep Space Network 15 Apr. 1977 p 77-82 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 22C

N77-21122*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A MARKOV MODEL FOR X-BAND ATMOSPHERIC ANTENNA-NOISE TEMPERATURES
O. H. Adeyemi *In its* The Deep Space Network 15 Apr. 1977 p 99-102 ref (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

N77-21125*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ENCODING AND DECODING A TELECOMMUNICATION STANDARD COMMAND CODE
B. Benjauthrit and T. K. Truong *In its* The Deep Space Network 15 Apr. 1977 p 115-119 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N77-21133*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A MODEL OF SNR DEGRADATION DURING SOLAR CONJUNCTION
S. T. Rockwell *In its* The Deep Space Network 15 Apr. 1977 p 187-198 (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-21183*# ECON, Inc., Princeton, N.J.
ECONOMIC ANALYSIS OF STANDARD INTERFACE MODULES FOR USE WITH THE MULTI-MISSION SPACECRAFT, VOLUME 1 Final Report
31 Aug. 1976 184 p
(Contract NASw-2558)
(NASA-CR-152655; Rept-76-103-1) Avail: NTIS HC A09/MF A01 CSCL 22B

A preliminary technical and economic feasibility study was made of the use of Standardized Interstate Modules (SIM) to perform electual interfacing functions that were historically incorporated into sensors. Sensor interface functions that are capable of standardization from the set of missions planned for the NASA Multi-Mission Spacecraft (MMS) in the 1981 to 1985 time period were identified. The cost savings that could be achieved through the replacement of nonstandard sensor interface flight hardware that might be used in these missions with SIM were examined. Author

N77-21184*# ECON, Inc., Princeton, N.J.
ECONOMIC ANALYSIS OF STANDARD INTERFACE MODULES FOR USE WITH THE MULTI-MISSION SPACECRAFT. VOLUME 2: APPENDICES AND DRAWINGS
Joel Greenberg, B. P. Miller, Samuel Russell, and Noel Becar (Kaman Sciences Corp.) 31 Aug. 1976 169 p
(Contract NASw-2558)
(NASA-CR-152656; Rept-76-103-1) Avail: NTIS HC A08/MF A01 CSCL 22B

The cost savings that could be obtained by the use of SIM to perform certain sensor electrical interfacing functions that were historically an integral part of the sensor are evaluated. Reduction in both the nonrecurring and recurring costs of this sensor interface hardware could be achieved through the use of SIM, and the study concludes that the development and use of certain power conditioning and data handling SIM units are economically justified. Author

N77-21185# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
FINITE-ELEMENT ANALYSIS OF CTS-LIKE FLEXIBLE SPACECRAFT
P. K. Nguyen and P. C. Hughes Jun. 1976 108 p refs Sponsored by Dept. of Communications, Ottawa
(UTIAS-205; CN-ISSN-0082-5255) Avail: NTIS HC A06/MF A01

The dynamics of a class of non-spinning flexible spacecraft are studied. The spacecraft consists of a relatively rigid center body to which a number of flexible appendages are rigidly attached. The center body has pitch, roll, and yaw attitude motion. Deformations of the appendages are assumed elastic, small in amplitude, and are studied via a finite-element analysis. Using a transformation from distributed displacements to finite-element displacements, the angular momenta and moments of inertia of the flexible appendages are expressed in terms of elemental inertia matrices. A simplified CTS (Communications Technology Satellite) model is used to illustrate a number of important points. Author

N77-21186# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
DESTRUCTION OF BASIC HAWK MISSILE ROCKET ENGINES [VERNIETIGING BASIC HAWK MISSILES, RAKETMOTOR]
R. U. Jongenburger and T. M. Groothuizen 31 Aug. 1976 26 p refs Partly in DUTCH and partly in FRENCH; ENGLISH summary
(Contract A76/KL/003)

(TL-1976-10; TDCK-68516) Avail: NTIS HC A03/MF A01

Measures to be taken to destroy the rocket engines of Basic Hawk Missiles were investigated. A test destruction was carried out at an infantry shooting range, supported by several measurements. The results of these measurments as well as the conclusions of the investigation are discussed. Advice is given on the method to be followed and the safety measures to be taken. Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N77-21187# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

MATHEMATICAL MODELS OF BODY FLEXIBILITY AND OF ERRORS IN RATE GYROS AND ACCELEROMETERS FOR MISSILES [MATHEMATISCHE MODELLE DER RUMPFFLEXIBILITAET UND DER FEHLER VON WENDEKREISELN UND BESCHLEUNIGUNGSMESSERN BEI FLUGKOERPERN]

N. Sander and G. Somieski 30 Nov. 1976 52 p refs In GERMAN

(DLR-IB-552-76/9) Avail: NTIS HC A04/MF A01

A simple model for the bending of a slender missile body, and models of errors in rate gyros and accelerometers, were set up. Flexibility was taken as a deterministic interference; the errors of inertial sensors are either deterministic or stochastic. ESA

N77-21188# Spacetac, Inc., Bedford, Mass.

DEVELOPMENT, FABRICATION AND SERVICE OF INSTRUMENTS FOR USE IN ELECTRICAL STRUCTURES AND RELATED SPACE FLIGHT MEASUREMENTS Technical Report, 30 Oct. 1974 - 28 May 1976

David Deltano, Bernard B. Hurwitch, Paul D. Murray, and Robert C. Vaillancourt Hanscom AFB, Mass. AFGL 25 May 1976 29 p

(Contract F19628-74-C-0218; ILIR Proj. 8617)

(AD-A032309; SR-1; AFGL-TR-76-0117) Avail: NTIS HC A03/MF A01 CSCL 09/5

The goals established at the onset of this program were fourfold: (1) design and fabricate: (a) a spherical electron sensor; (b) a planar ion sensor; (2) design and fabricate a low voltage power converter; (3) design and develop a nine (9) bit successive approximation ADC; and (4) design and build suitable test equipment for thorough testing of the SS/IE plasma electronics. The most noteworthy achievement concerns the variety of assembly techniques that were tried and failed in the assembly phase of the planar and spherical sensors. This phase pointed out that the simpler a technique is, the more reliable and easier it is. Author (GRA)

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-21189*# Rocketdyne, Canoga Park, Calif.

AEROSPIKE THRUST CHAMBER PROGRAM Final Report

J. Campbell, Jr. and S. M. Cobb Dec. 1976 167 p refs

(Contract NAS3-20076)

(NASA-CR-135169; R76-189) Avail: NTIS HC A08/MF A01 CSCL 21H

An existing, but damaged, 25,000-pound thrust, flightweight, oxygen/hydrogen aerospike rocket thrust chamber was disassembled and partially repaired. A description is presented of the aerospike chamber configuration and of the damage it had suffered. Techniques for aerospike thrust chamber repair were developed, and are described, covering repair procedures for lightweight tubular nozzles, titanium thrust structures, and copper channel combustors. Effort was terminated prior to completion of the repairs and conduct of a planned hot fire test program when it was found that the copper alloy walls of many of the thrust chamber's 24 combustors had been degraded in strength and ductility during the initial fabrication of the thrust chamber. The degradation is discussed and traced to a reaction between oxygen and/or oxides diffused into the copper alloy during fabrication processes and the hydrogen utilized as a brazing furnace atmosphere during the initial assembly operation on many of the combustors. The effects of the H2/O2 reaction within the copper alloy are described. Author

N77-21190*# Hughes Research Labs., Malibu, Calif. Dept. of Ion Physics.

HIGH-POWER AND 2.5 kW ADVANCED-TECHNOLOGY ION THRUSTER Final Report, 27 May 1975 - 26 Sep. 1976

R. L. Poeschel Feb. 1977 135 p refs

(Contract NAS3-19703)

(NASA-CR-135163) Avail: NTIS HC A07/MF A01 CSCL 21C

Investigations for improving ion thruster components in the 30 cm engineering model thruster (EMT) resulted in the demonstration of useful techniques for grid short removal and discharge chamber erosion monitoring, establishment of relationships between double ion production and thruster operating parameters, verification of satisfactory specifications on porous tungsten varporizer material and barium impregnated porous tungsten inserts, demonstration of a new hollow cathode configuration, and specification of magnetic circuit requirements for reproducing desired magnetic mappings. The capacity of a 30 cm EMT to operate at higher beam voltages and currents (higher power) was determined. Operation at 2 A beam current and higher beam voltage is shown to be essentially equivalent to operation at 1.1 kV with regard to efficiency, lifetime and operating conditions. The only additional requirement is an improvement in high voltage insulation and propellant isolator capacity. Operation at minimum voltage and higher beam currents is shown to increase thruster discharge chamber erosion in proportion to beam current. Studies to find alternatives to molybdenum for manufacturing ion optics grids are also reported. Author

N77-21191*# Aerojet Liquid Rocket Co., Sacramento, Calif.

ACOUSTIC CAVITY TECHNOLOGY FOR HIGH PERFORMANCE INJECTORS Final Report

1 Oct. 1976 151 p refs

(Contract NAS9-14232)

(NASA-CR-151331; Rept-3-1) Avail: NTIS HC A08/MF A01 CSCL 21H

The feasibility of damping more than one mode of rocket engine combustion instability by means of differently tuned acoustic cavities sharing a common entrance was shown. Analytical procedures and acoustic modeling techniques for predicting the stability behavior of acoustic cavity designs in hot firings were developed. Full scale testing of various common entrance, dual cavity configurations, and subscale testing for the purpose of obtaining motion pictures of the cavity entrance region, to aid in determining the mechanism of cavity damping were the two major aspects of the program. Author

N77-21192# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Energiewandlung und Elektrische Antriebe.

THEORY OF THE HIGH TEMPERATURE HOLLOW CATHODE, A MODEL OF THE CATHODE MECHANISM

Harro Bessling 22 Sep. 1976 51 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-377)

(DLR-FB-76-50) Avail: NTIS HC A04/MF A01; DFVLR, Cologne, DM 21,50

The hollow cathode in the discharge chamber of the electrostatic Kaufman thruster differs from the conventional hollow cathodes in allowing essentially higher operational temperatures,

extremely small geometric measurements, higher discharge currents, and considerably lower discharge potential. In order to be able to design this cathode with regard to a required long life time and a good generating efficiency of electrons, the mechanism of cathode must be known. Using experimental results, a function model for a high temperature hollow cathode without additional low work function material was developed, from which a quantitative relationship between the operational data was derived. The theoretical values are compared with the measured values in the test plant. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N77-21193*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESIDUAL STRESSES IN BORON/TUNGSTEN AND BORON/CARBON FIBERS
D. R. Behrendt 1977 9 p refs Presented at 106th Ann. Meeting of the Metallurgical Soc. of the Am. Inst. of Mining, Metallurgical and Petroleum Engr., Atlanta, 6-10 Mar. 1977
(NASA-TM-X-73616) Avail: NTIS HC A02/MF A01 CSCL 11D

By measuring the change in fracture stress of 203 micrometer diameter fibers of boron on tungsten (B/W) as a function of fiber diameter as reduced by chemical etching, it is shown that the flaws which limit B/W fiber strength are located at the surface and in the tungsten boride core. After etching to a diameter of 188 micrometers m virtually all fiber fractures were caused by core flaws, the average strength being 4.50 GN/sq m. If both the surface and core flaws are removed, the fracture strength, limited by flaws in the boron itself, is approximately 6.89 GN/sq m. This was measured on B/W fibers which were split longitudinally and had their cores removed by chemical etching. The longitudinal residual stress distribution was determined for 102 micrometer diameter B/W and B/C fibers.
Author

N77-21194*# Old Dominion Univ. Research Foundation, Norfolk, Va.
RESULTS OF BORON-ALUMINUM THRUST STRUCTURE Interim Report
M. W. Hyer (Old Dominion Univ.) and Michael C. Lightfoot (Old Dominion Univ.) Dec. 1976 42 p refs
(Grant NsG-1167)
(NASA-CR-146973) Avail: NTIS HC A03/MF A01 CSCL 11D

Results are presented of testing-to-failure a two member boron-aluminum thrust structure. The structure represented one section of a more complex planar truss and was designed to test the integrity of a diffusion bonded joint. The structure failed at 107 percent of the ultimate design load in the diffusion bond region. Strain gages and displacement transducers were used to measure loads and deflections of the truss. The experimentally derived axial loads, bending moments, and torsion in the various members are presented and compared with predicted values.
Author

N77-21195*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
INTERLAMINAR STRESSES IN COMPOSITE LAMINATES: A PERTURBATION ANALYSIS
Peter W. Hsu and Carl T. Herakovich Jan. 1976 109 p refs
(Grant NGR-47-004-090)
(NASA-CR-148080; VPI-E-76-1) Avail: NTIS HC A06/MF A01 CSCL 11D

A general method of solution for an elastic balanced symmetric composite laminate subject to a uniaxial extension was developed based upon a perturbation analysis of a limiting free body containing an interfacial plane. The solution satisfies more physical requirements and boundary conditions than previous investigations, and predicts smooth continuous interlaminar stresses with no instabilities. It determines the finite maximum intensity for the interlaminar normal stress in all laminates, provides mathematical evidences for the singular stresses in angle-ply laminates, suggests the need for the experimental determination of an important problem parameter, and introduces a viable means for solving related problems of practical interest. Author

N77-21196# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE DETERMINATION OF ELASTIC AND THERMOELASTIC CONSTANTS OF COMPOSITE MATERIALS
V. M. Levin [1976] 10 p refs Transl. into ENGLISH from Izv. Akad. Naut SSR, Mekhan. Tuerd. Tela (USSR), v. 6, 1976 p 137-145
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

An approximate method of determining the effective elastic moduli and coefficients of thermal expansion of matrix composite materials is proposed. A survey and brief characteristic of these methods are included along with a definition of the macroscopic stress and strain fields. B.B.

N77-21197# Bendix Corp., Kansas City, Mo.
CARBON MICROSPHERE/FIBER/POLYIMIDE BINDER SYNTACTIC COMPOSITE
R. J. McWhirter Sep. 1976 29 p refs
(Contract E(29-1)-613)
(BDX-613-1636-Rev) Avail: NTIS HC A03/MF A01

A manufacturing process for syntactic foam billets was developed, and the progression through the mixing, blending, and molding operations is discussed. With basic requirements for a lightweight, thermally conductive, high strength foam, resolution was attained in a mix of a polyimide resin, carbon microspheres, and graphite fiber. ERA

N77-21198# Los Alamos Scientific Lab., N. Mex.
HIGH SPECIFIC HEAT METALS FOR USE IN SUPERCONDUCTING COMPOSITES
S. S. Rosenblum, H. Sheinberg, and W. A. Stevert 1976 3 p refs Presented at the 1976 Applied Superconductivity Conf., Palo Alto, Calif., 17-20 Aug. 1976
(Contract W-7405-Eng-36)
(LA-UR-76-1790; Conf-760829-21) Avail: NTIS HC A02/MF A01

In an effort to enhance adiabatic stability, copper containing percentage amounts of Gd2O3 powder was prepared. The specific heat (C/sub v/) of the resulting material was measured at temperatures from 2 to 12 K in zero and 2.4 T applied magnetic field. Below 5 K the C/sub v/ is one to two orders of magnitude higher than that of ordinary copper. For example, at 3.7 K in zero field the C/sub v/ of 2.4 percent GdAlO3 is 1.5 mJ/g-K and for 7.2 percent Gd2O3 C/sub v/ in 3.7 mJ/g-K. These results are only weakly dependent on the magnetic field. Resistance ratios (room temperature to 4 K) of 99 to 46 are obtained, depending on the method of preparation. Mechanical properties of the copper seem good; photomicrographs of the material are shown. Additional cost for materials is $1.20 per pound for 3 percent oxide in copper. ERA

N77-21199# General Atomic Co., San Diego, Calif.
STATISTICAL STUDY OF THE STRENGTH OF NEAR-ISOTROPIC GRAPHITE
R. J. Price 24 May 1976 161 p refs
(Contract E(04-3)-0167)
(GA-A-13955) Avail: NTIS HC A08/MF A01

More than 2,000 tensile and four-point bend tests were made at ambient temperature on specimens from one log of extruded near-isotropic petroleum-coke-based nuclear graphite. The mean strengths showed the expected systematic dependence on orientation and location, with axial specimens stronger than

radial specimens and material near the edge of the log stronger than material near the centerline. There were additional local fluctuations in strength which, in some cases, corresponded to local variations in density. The coefficient of variation was lower for axial specimens than for radial specimens, and lower for bend specimens than for tensile specimens. The cumulative strength distribution could be fitted equally well by a normal (Gaussian) distribution or by a Weibull distribution. ERA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N77-21200 Engineering Sciences Data Unit, London (England).
THERMAL CONDUCTIVITY OF CARBON DIOXIDE GAS AND LIQUID
Nov. 1976 26 p
(ESDU-76030; ISBN-0-85679-167-9) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. (write for prices)

Equations and values in SI units of the thermal conductivity of carbon dioxide for temperatures between 240 K and 1500 K and for pressures from 1 to 1000 bar are reported. The data are presented in the form of tables generated by computer. Tables of variation of the thermal conductivity of carbon dioxide with temperature along the saturation line and variation with temperature and pressure in the single-phase region are provided. The detailed variation of the thermal conductivity of carbon dioxide in the critical region is given as a function of density and temperature. Pressures corresponding to the thermal conductivity are listed. Author

N77-21201*# Kanner (Leo) Associates, Redwood City, Calif.
ACTIVE FERRIC AND CUPRIC COMPOUNDS AS INORGANIC CATALYSTS IN PEROXIDIZING OXIDATION REACTIONS IN THE LIGHT OF THEORIES OF OXYGEN ACTIVATION AND HYDROGEN ACTIVATION
Alfons Krause Washington NASA Apr. 1977 8 p refs Transl. into ENGLISH from Roczniki Chemii (Warsaw), v. 19, 1939 p 481-486
(Contract NASw-2790)
(NASA-TT-F-17420) Avail: NTIS HC A02/MF A01 CSCL 07D

The activity of a mixed catalyst combining cupric and ferric hydroxides in catalytic oxidation reactions of indigo dye or formic acid, for example, is discussed in terms of oxygen or hydrogen activation. It is pointed out that the activation of oxygen in the reaction is also viewed as dehydrogenation of metal oxides. This view reconciles the Manchot and Wieland views used and explains the activity of ferric compounds in oxidation reactions. Author

N77-21202# Lockheed Missiles and Space Co., Palo Alto, Calif.
METHOD OF DETERMINING ZINC OXIDE
Kh. K. Ospanov, S. D. Alimpeva, O. A. Songina, R. S. Omarova, A. A. Suviatsov, and E. M. Timokhin [1976] 2 p Transl. into ENGLISH from Biull. Otkryt., izobret., prom. obraztsy, Tover. Znaki (Poland), v. 47, no. 10, 1970 p 130
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

A method is presented for determining zinc oxide in the presence of metallic zinc in alloys. A solution of ammonium acetate is used to separate the zinc oxide from the metallic zink. Different oxidation inhibitors are introduced into the solution to avoid oxidation of the metal during the treatment. The method is applicable for the analysis of alloys, slags, and other metals. I.M.

N77-21203*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AIRCRAFT SEAT CUSHION MATERIALS TESTS
R. W. Bricker 8 Oct. 1975 25 p ref
(NASA-TM-X-74632; JSC-09929) Avail: NTIS HC A02/MF A01 CSCL 13L

Five component level flammability tests were conducted in a 400 cubic foot chamber to determine the products of combustion and relative destruction of coated (with fire-retardants) and uncoated polyurethane foams during exposure of the foams to a large flaming ignition source for five minutes. The test results indicate that the improved state-of-the-art polyurethane foams without the added fire retardant and coating treatments were not significantly better than untreated older less fire-resistant polyurethane foams. however, by treating and coating the state-of-the-art foams, the production of toxic gases was delayed and the destruction of the foam limited. Author

N77-21204# Central Technical Inst. TNO, Apeldoorn (Netherlands).
HYDROGEN COMBUSTION. PART 1: INVESTIGATION OF HYDROGEN FLAME CONTROL METHODS [WATERSTOFVERBRANDING. DEEL 1: ONDERZOEK NAAR BEVEILIGINGSMETHODEN VAN WATERSTOFVLAMMEN]
J. DeBoer and J. P. A. VanHeteren Mar. 1975 15 p In DUTCH
(CTI-IV-75-01449) Avail: NTIS HC A02/MF A01

Measurements were carried out on natural gas, H2S and H2 flames in order to determine the possibilities of flame control. The following flame detection principles were tested: optical detection, flame ionization detection, and thermal detection. UV control is possible for natural gas and H2S. Visible detection is applicable only to H2S. IR detection is possible for natural gas, H2S, and, especially, for H2. Flame ionization is applicable only to natural gas. Thermal control is feasible for natural gas and H2. ESA

N77-21205# Central Technical Inst. TNO, Apeldoorn (Netherlands).
APPLICATION OF A FLAME IONIZATION DETECTOR TO THE ANALYSIS OF SMOKE EXHAUSTS [ONDERZOEK VOOR HET TOEPASSEN VAN EEN VLAMIONISATIEDETECTOR BIJ ROOKGASANALYSE]
C. H. Venderbos May 1975 20 p refs In DUTCH
(CTI-IV-02-7-10090) Avail: NTIS HC A02/MF A01

A flame ionization detector was used to measure the constituents of incinerator smoke: N2, CO2, O2, SO2, and CO. N2 was taken as 'zero' gas. The effect of individual components on the indication of the detector showed a displacement of the null and a change in sensitivity. The first effect resulted for all components; the second, only for O2 and CO2 (reproducible). A concentration of hydrocarbon in smoke can be detected as from 10 ppm. ESA

N77-21206# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
COHERENT ANTI-STOKES RAMAN SCATTERING NEAR ELECTRONIC RESONANCE AND REALIZATION OF AN EXPERIMENTAL SET-UP Ph.D. Thesis - Paris-Sud Univ.
Sylvie Druet Oct. 1976 74 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-371)
(ONERA-NT-1976-6; FR-ISSN-0078-3781) Avail: NTIS HC A04/MF A01

The application of spectroscopy to gases by Coherent Anti-Stokes Raman Scattering (CARS) is discussed. The characteristic features of CARS are reviewed along with the latest achievements. The use of electronic resonances is then sought for improving the detectivity of this method. Different cases of resonant excitation can be inferred from the quantum mechanical expression of the susceptibility. In each case, the difficulties associated with resonant CARS are pointed out, and detectivity improvement is estimated from resonant spontaneous Raman scattering data. The experimental setup incorporating two tunable dye lasers is described. Author (ESA)

N77-21207# Laboratoire d'Aérothermique du C.N.R.S., Meudon (France).
EQUILIBRIUM CONCENTRATIONS OF AN IONIZED MIXTURE OF NITROGEN AND WATER [CONCENTRA-

TIONS A L'EQUILIBRE D'UN MELANGE IONISE D'AZOTE ET D'EAU]
G. Poissant and R. Prudhomme Jul. 1976 168 p refs In FRENCH
(Rept-76-1; Publ-525) Avail: NTIS HC A08/MF A01

The chemical equilibrium of an ionized mixture of water and nitrogen for given mixture rates and under fixed temperature and pressure conditions was investigated. Equilibrium concentrations were calculated taking into account as many chemical species as possible. The temperature range covers temperatures up to 6000 K, pressure range is between 1/100,000 and 1/10 atm, and mixture rates between 1/10,000 and 1. A comparison is made with pure nitrogen plasma, or a weak mixture rate, at the same pressure and temperature conditions. The effect of mixture rate on nitrogen dissociation rate is noted. ESA

N77-21208# Texas A&M Univ., College Station. Ocean Engineering Program.
INFLUENCE OF THE SUPRAMOLECULAR MARINE ENVIRONMENT ON PITTING CORROSION
Denton B. Harris, Bob M. Gallaway, and John B. Herbich Aug. 1976 50 p refs
(Grant NOAA-04-5-158-19)
(PB-260924/6; COE-192; TAMU-SG-76-211; NOAA-76092301) Avail: NTIS HC A03/MF A01 CSCL 07D

Rupture of the passive film is described in terms of its sensitivity to attack by negatively hydrated ions. A corollary is suggested which describes the inhibiting effect of various positively hydrated ions. The role of marine microorganisms is discussed as it relates to those environmental modifications that may contribute to pit nucleation. GRA

N77-21209# Arizona Univ., Tucson. Dept. of Chemistry.
CONSIDERATIONS WHEN EMPLOYING INTERACTIVE COMPUTER CONTROL FOR STUDY OF COMPLEX FLAME SYSTEMS
M. Bonner Denton and M. W. Routh 1976 25 p refs Submitted for publication
(Contract N00014-75-C-0513; NR Proj. 051-549)
(AD-A031758; TR-8) Avail: NTIS HC A02/MF A01 CSCL 21/2

Investigations employing interactive computer control as a means for effectively investigating fundamental processes occurring within the complex heterogenous flame systems commonly employed for flame spectrochemical analysis are described. The capabilities of the present system for flame profiling and optimization as well as considerations inherent in extending these techniques to the study of pyrotechnic flares are presented. GRA

N77-21210# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
CONSTANT-VOLUME FLAME PROPAGATION: FINITE-SOUND-SPEED THEORY
Edward J. Kansa and Henry E. Perlee Oct. 1976 33 p refs
(PB-261335/4; BM-RI-8163) Avail: NTIS HC A03/MF A01 CSCL 21B

The unsteady, spherically-symmetric, one-dimensional, compressible-flow equations were solved numerically for a spherical deflagration propagating concentrically in a spherical vessel with Mach numbers ranging from 0.2 to 0.7. Trajectory histories agree with the infinite sound speed theory developed by Perlee, Fuller, and Saul. Various examples were given and discussed. GRA

N77-21211# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
FLAME AND PRESSURE DEVELOPMENT OF LARGESCALE CH4-AIR-N2 EXPLOSIONS. BOUYANCY EFFECTS AND VENTING REQUIREMENTS Report of investigations 1976
M. J. Sapko, A. L. Furno, and J. M. Kuchta Oct. 1976 39 p refs
(PB-261331/3; BM-RI-8176) Avail: NTIS HC A03/MF A01 CSCL 21B

The pressure and flame development of the methane-air-nitrogen system were investigated in the Bureau's 12-foot diameter sphere to define buoyancy effects and to develop relationships for predicting venting requirements. Pressure rise (delta P) is defined as a function of time (t) and nitrogen dilution and shown to deviate noticeably from the cubic law (delta P = K (t cubed)), depending upon the period of combustion and the mixture composition. Corresponding flame speed (Sf) and burning velocity (Su) data are given that show that Sf is time dependent and that N2 dilution has a greater effect than air dilution in inhibiting the flame propagation. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N77-21212 Central Electricity Generating Board, London (England).
FRETTING CORROSION AND FRETTING FATIGUE: A SELECTIVE BIBLIOGRAPHY, 1972-1976
I. W. Prior, comp. Mar. 1977 22 p refs
(CE-Bib-258) Issuing Activity

A bibliography containing listings of books, reviews, and general articles on some of the following topics: (1) Fatigue properties of materials, (2) Ferrous and non-ferrous metals, (3) Fretting corrosion, (4) Fretting fatigue, and (5) Fatigue behavior of metallic materials. B.B.

N77-21213*# Case Western Reserve Univ., Cleveland, Ohio.
SURFACE ASPECTS OF PITTING AND STRESS CORROSION CRACKING Final Report, Sep. 1974 - Mar. 1977
J. S. Truhan, Jr. and R. F. Heheman Apr. 1977 92 p refs
(Grant NGR-36-027-051)
(NASA-CR-152736) Avail: NTIS HC A05/MF A01 CSCL 11F

The pitting and stress corrosion cracking of a stable austenitic stainless steel in aqueous chloride environments were investigated using a secondary ion mass spectrometer as the primary experimental technique. The surface concentration of hydrogen, oxygen, the hydroxide, and chloride ion, magnesium or sodium, chromium and nickel were measured as a function of potential in both aqueous sodium chloride and magnesium chloride environments at room temperature and boiling temperatures. It was found that, under anodic conditions, a sharp increase in the chloride concentration was observed to occur for all environmental conditions. The increase may be associated with the formation of an iron chloride complex. Higher localized chloride concentrations at pits and cracks were also detected with an electron microprobe. Author

N77-21214*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE STRESS CORROSION RESISTANCE AND THE CRYOGENIC TEMPERATURE MECHANICAL PROPERTIES OF HOT ROLLED NITRONIC 32 BAR MATERIAL
J. W. Montano Apr. 1977 24 p refs
(NASA-TM-X-73375) Avail: NTIS HC A02/MF A01 CSCL 11F

The ambient and cryogenic temperature mechanical properties and the ambient temperature stress corrosion properties of hot rolled and centerless ground Nitronic 32 stainless steel bar material are presented. The mechanical properties of longitudinal specimens were evaluated at test temperatures from ambient to liquid hydrogen. The tensile test data indicated increasing smooth tensile strength with decreasing temperature to liquid hydrogen temperature. However, below -200 F (-129.0 C) the notched tensile strength decreased slightly and below -320 F (-196.0 C) the decrease was significant. The elongation and reduction of area decreased drastically at temperatures below -200 F (-129.0 C). The Charpy V-notched impact energy decreased steadily with decreasing test temperature. Stress corrosion tests were performed on longitudinal tensile specimens stressed to 0, 75, and 90 percent of the 0.2 percent yield strength and on transverse 'C'-ring specimens stressed to 75 and 90 percent of the yield strength and exposed to: alternate immersion in a 3.5 percent NaCl bath, humidity cabinet environment, and a 5 percent salt spray atmosphere. The longitudinal tensile specimens experienced no corrosive attack; however, the 'C'-rings exposed to the alternate immersion and to the salt spray

experienced some shallow etching and pitting, respectively. Small cracks appeared in two of the 'C'-rings after one month exposure to the salt spray. Author

N77-21215*# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.
INVESTIGATION OF THE FRACTURE MECHANISM IN Ti-5Al-2.5Sn AT CRYOGENIC TEMPERATURES Final Report
R. H. VanStone, J. R. Low, Jr., and J. L. Shannon, Jr. Apr. 1977 112 p refs
(Contract NGR-39-087-047)
(NASA-CR-135120; CMU-NASA-3Ti) Avail: NTIS HC A06/MF A01 CSCL 11F

The influence of microstructure on the fracture mechanism and plane-strain fracture toughness of Ti-5Al-2.5Sn was studied through the use of fractography and metallographic sectioning techniques. One-inch thick plates of extra low interstitial (ELI) and normal interstitial Ti-5Al-2.5Sn were mill annealed at 815 C followed by either air or furnace cooling. These variations in composition and cooling rate resulted in differences in the volume fraction and internal structure of the iron-stabilized phase, and in the crystallographic texture and ordering of the alpha matrix. The tensile properties of these plates were determined at 20 K, 77 K, and 295 K. The air-cooled ELI plate was the toughest material evaluated. Author

N77-21216*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUSCEPTIBILITY TO HOT CORROSION OF FOUR NICKEL-BASE SUPERALLOYS, NASA-TRW VIA, B-1900, 713C AND IN-738
Carl A. Stearns, Fred J. Kohl, and George C. Fryburg Apr. 1977 19 p refs
(NASA-TN-D-8461; E-8977) Avail: NTIS HC A02/MF A01 CSCL 11F

The susceptibility to hot corrosion of four nickel-base, cast superalloys has been studied at 900 and 1000 C. The test consisted of coating alloy samples with known amounts of Na2SO4 and oxidizing the coated samples isothermally in 1 atmosphere of slowly flowing oxygen, the weight-gain being monitored on a sensitive recording microbalance. Susceptibility to hot corrosion decreased in the order of decreasing molybdenum content of the alloys. Preoxidation of samples before hot-corrosion testing markedly increased the induction period observed prior to the inception of hot corrosion for all alloys tested. X-ray diffraction analyses of the oxide scales were made. All samples that underwent hot corrosion showed the presence of a (Ni,Co)MoO4 layer near the alloy-oxide interface. Several specimens displayed resistance to hot corrosion and these showed NaTaO3 as a prominent feature in their oxide scale. Our results may be interpreted as indicating that molybdenum in an alloy is detrimental, with respect to hot corrosion, while tantalum is beneficial. Author

N77-21217*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REDUCED CHROMIUM STAINLESS STEEL ALLOYS Patent Application
Joseph R. Stephens and Charles A. Barrett, inventors (to NASA) Filed 15 Apr. 1977 9 p
(NASA-Case-LEW-12543-1; US-Patent-Appl-SN-788044) Avail: NTIS HC A02/MF A01 CSCL 11F

An austenitic stainless steel alloy is provided which contains reduced amounts of chromium as compared with stainless steels such as AISI Type 304 but whose oxidation resistance, corrosion resistance, strength and ductility are at least as good as those of such stainless steels. In a preferred embodiment, the alloy comprises, by weight percent, iron-12 chromium-10 nickel-2 aluminum-2 molybdenum-1.1 manganese-0.61 silicon-0.06 carbon. In a second preferred embodiment, the alloy comprises, by weight percent, iron-12 chromium-10 nickel-2.65 silicon-1.1 manganese-0.06 carbon. NASA

N77-21218# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
RELATIONSHIP BETWEEN ANELASTIC AND NON-LINEAR VISCO-PLASTIC BEHAVIOR OF 316 STAINLESS STEEL AT LOW HOMOLOGOUS TEMPERATURE
N. Nir, F. H. Huang, E. W. Hart (General Electric, Schenectady, N. Y.), and C. Y. Li May 1976 26 p refs
(Contract E(11-1)-2172)
(COO-2172-12) Avail: NTIS HC A03/MF A01

At low homologous temperature the plastic strain rate seems to be controlled largely by dislocation glide friction. However, since a sizeable fraction of the applied stress sigma is dissipated in overcoming the strong barriers due to dislocation tangles generated by strain hardening, only a portion of the applied stress is actually expended against the frictional resistance. A recent model for this process includes the role of dislocation pile-ups at the strong barriers. The pile-ups provide a mechanism for producing the internal back stresses that limit the effective frictional stress. They also appear in the deformation as a stored anelastic strain component. The resultant behavior at low temperature and high stress is similar to that proposed by Grupta and Li. The same model also predicts an anelastic behavior at low stress. Measurements at both high and low stress levels on 316 Stainless Steel have now shown that the predictions of the model are quantitatively consistent at both stress levels. GRA

N77-21219# Maryland Univ., College Park.
INVESTIGATION OF IRRADIATION STRENGTHENING OF bcc METALS AND THEIR ALLOYS Progress Report, Jan. - Oct. 1976
1976 176 p refs
(Contract AT(40-1)-3612)
(ORO-3612-13) Avail: NTIS HC A09/MF A01

Research on irradiation of bcc metals and alloys is reported. Data and information are presented in appendixes on low temperature neutron irradiation of Nb, effects of tritium on the yield stress of Nb, multiple dislocation motion, dislocation group motion, dislocation kinetics, and computer simulation of dislocation motion. ERA

N77-21220# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ALUMINUM BASE ORIENTED EUTECTICS: FABRICATION, STRUCTURE AND PROPERTIES OF AN Al-Ce-Ni-Mn PSEUDOBINARY EUTECTIC Ph.D. Thesis - Rouen Univ., France
Francois Daurelle Jun. 1976 58 p refs In FRENCH; ENGLISH summary
(ONERA-NT-1976-4; FR-ISSN-0078-3781) Avail: NTIS HC A04/MF A01

Work concerning the development of aluminum base, oriented eutectic alloys, was surveyed with the aim of obtaining a stable material resisting temperatures up to about 300 C. Based on the ternary Al-Ce-Ni eutectic, the resistance of which might be increased by the addition of Mn, the existence of a pseudo-binary eutectic in the quaternary alloys obtained was shown. The fabrication of an oriented structure of the Al-Ce-Ni-Mn pseudo-binary eutectic is described. The effects of thermal treatments on the stability of this alloy were investigated; results of mechanical tests on the material, either oriented or as-cast, are reported. Author (ESA)

N77-21221# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MARTENSITIC TRANSFORMATIONS IN THE IRON-NICKEL-MANGANESE SYSTEM Ph.D. Thesis - Paris 6 Univ.
Jean Lacomme Oct. 1976 42 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-363)
(ONERA-NT-1976-7; FR-ISSN-0078-3781) Avail: NTIS HC A03/MF A01

The iron-rich phase of the phase diagram of the iron-nickel-manganese system was studied at room temperature and at low temperature by transmission electron microscopy. It was thus possible to study the various martensitic transformations, gamma leads to alpha, occurring in this part of the diagram, and to measure the temperatures Ms of the transformation start of these alloys. It was also possible to study the structure and the nucleation of the alpha and epsilon martensites and to verify the orientation relations characterizing the transformations creating them. The influence of composition and of Ms on the type of

martensite formed was ascertained. The stacking fault energy variation with temperature during the gamma leads to epsilon transformation in the Fe-8 Ni-12 Mn alloy was evaluated. A few magnetization measurements permitted the determination of the points Ms and the comparison of these values with those obtained at the electron microscope. Lastly, the phase diagram obtained showed that the austenitic phase gamma is more stable than indicated by previous studies, which served as references, and that has not been clearly explained.

Author (ESA)

N77-21222# National Bureau of Standards, Boulder, Colo. Cryogenics Div.

FATIGUE CRACK GROWTH AND J-INTEGRAL FRACTURE PARAMETERS OF Ti-6Al-4V AT AMBIENT AND CRYOGENIC TEMPERATURES

Ralph L. Tobler 1976 27 p refs Repr. from ASTM Special Tech. Publ. 601, 1976 p 346-370 Sponsored in part by AF (PB-261041/8) Avail: NTIS HC A03/MF A01 CSCL 11F

The fatigue-crack growth rates were temperature independent at stress intensity ranges (delta K) from 10 to 20 MN/m to the 3/2 power. Above 20 MN/m to the 3/2 power, the rates increased with decreasing temperature. Plane-strain liner-elastic and J-integral fracture test results were in good agreement: the fracture toughness of this alloy decreased from about 110 MN/m to the 3/2 power at room temperature to 54 MN/m to the 3/2 power at 4 K, with a ductile-to-brittle fracture transition occurring in the range 125 K to 76 K. These fatigue and fracture results are compared with data previously reported for a normal-interstitial Ti-6Al-4V alloy. GRA

N77-21223# National Bureau of Standards, Washington, D. C.

ALLOY PHASE DIAGRAM DATA Final Report

L. H. Bennett, D. J. Kahan, and G. C. Sarter 26 Feb. 1976 19 p refs Repr. from Mater. Sci. Eng. (Netherlands), v. 24, 1976 p 1-17

(PB-260863/6) Avail: NTIS HC A02/MF A01 CSCL 11F

An annotated list of references including the major compilations of data on alloy phase diagram, crystallography, and thermodynamics and some useful reviews and theoretical discussions of alloy phase diagrams is presented. GRA

N77-21224# National Bureau of Standards, Washington, D. C. Inst. for Materials Research.

FIELD ION MICROSCOPY OF ZIRCONIUM

J. J. Carroll and A. J. Melmed 26 Mar. 1976 6 p refs Repr. from Surface Science, vol. 58, no. 2, Aug. 1976 p 601-604

(PB-260817/2) Avail: NTIS HC A02/MF A01 CSCL 11F

Zirconium was successfully imaged in the field ion microscope using neon ions and mixtures of helium and neon ions at specimen temperatures of about 30 K. Micrographs obtained after zirconium was exposed to hydrogen imaging conditions showed features that may indicate the early stage development of cracks, mostly along the (1,1,-2,0) to (1,1,-2,2) zone. GRA

N77-21225# National Materials Advisory Board, Washington, D. C.

MANGANESE RECOVERY TECHNOLOGY

1976 88 p refs Sponsored in part by the US Dept. of Commerce and the US Bureau of Mines

(Contract GS-00-DS-(P)-94008)

(PB-261707/4; NMAB-323) Avail: NTIS HC A05/MF A01 CSCL 11F

The available information on the known domestic deposits of the lower-grade manganiferous materials that might have to be used if self-sufficiency in manganese is ever required was evaluated with the information available on processes that might be used to recover manganese from such domestic raw materials. Three resource areas and two processes are identified as the most promising. Specific research and development projects such as joint industry-government efforts to determine the most feasible resource-process combinations are recommended. GRA

N77-21226# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.

THE BAINITE AND MASSIVE TRANSFORMATIONS IN Ti-X EUTECTOID SYSTEMS Interim Report, 31 Aug. 1975 - 31 Jul. 1976

H. I. Aaronson, G. W. Franti, and M. R. Pcichta 11 Aug. 1976 24 p refs

(Grant AF-AFOSR-2595-74; AF Proj. 9761)

(AD-A031657; AFOSR-76-1123TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

The survey of eutectoid decomposition mechanisms in hypoeutectoid Ti-X alloys has been virtually completed. At temperatures from the eutectoid to the Ms in the Ti-Bi, Ti-Co, Ti-Cu, Ti-Ni, Ti-Pb and Ti-Pd systems, the bainite reaction is the only one operative. Among the eutectoid alloys studied, Ti-Co, Ti-Cr, and Ti-Cu exhibit eutectoid decomposition essentially only by the pearlite reaction and Ti-Ni, Ti-Pd, and Ti-Pt transform predominantly or only by the bainite reaction; eutectoid decomposition by either mechanism has yet to be observed (because of its exceedingly slow kinetics) in the Ti-Fe, Ti-Ir, and Ti-Mn eutectoid alloys. A theoretical discussion is presented of the nucleation and growth kinetics of intermetallic compound crystals at fixed and at moving alpha:beta boundaries. In studies of the massive transformation, beta-alpha sub m, in Ti-Ag, Ti-Au, Ti-Si and Ti-In alloys, the composition region in which this transformation occurs in each alloy system was defined. By means of continuous cooling experiments, the enthalpy of transformation and the average rate of growth as a function of temperature were determined in a number of alloys in the four systems. GRA

N77-21227# Michigan Technological Univ., Houghton.

RELATION BETWEEN ELECTRONIC STRUCTURE AND THE MECHANICAL PROPERTIES OF BODY-CENTERED CUBIC METALS Final Report, 1 Oct. 1971 - 31 Jul. 1976

D. F. Stein and G. W. Shannatte 30 Jun. 1976 35 p refs

(Grants DA-ARO(D)-31-124-72-G38;
DA-ARO(D)-31-124-73-G142)

(AD-A031808; ARO-10453.2-MC) Avail: NTIS HC A03/MF A01 CSCL 11/6

The objective of this program was the understanding of the role of alloying elements in promoting ductility in BCC metals. The program considered the roles of both increased cohesive strength of solids and enhanced plastic deformation in improving the resistance of a solid to fracture. Various approaches were used to evaluate changes that could affect the fracture behavior. These included estimates of true surface energy and fracture stress using interatomic potential functions, and the effect of plastic deformation using a model crack that allowed plastic deformation at the crack tip. Measurements were made of elastic constants, magnetic susceptibility, and fracture energies of pure metals and alloys. Several alloys were studied including Fe-Si, W-Re, W-Ta, Nb-Zr, and Nb-Hf. GRA

N77-21228# Michigan Technological Univ., Houghton.

INTERFACIAL STRUCTURE, GROWTH KINETICS AND MECHANISMS OF THE PROEUTECTOID FERRITE REACTION IN Fe-C AND Fe-C-X ALLOYS

H. I. Aaronson and J. M. Rigsbee 7 Oct. 1976 72 p refs

(Grants DA-ARO(D)-31-124-73-G144; DAHC04-75-G-0154)

(AD-A032073; ARO-11264.17-MC; Rept-17) Avail: NTIS HC A04/MF A01 CSCL 11/6

One major program was an experimental study of the interfacial structure of the broad faces of ferrite plates in an Fe-C-Si alloy. The second major investigation comprised an experimental study of the growth kinetics of grain boundary ferrite allotriomorphs as a function of reaction temperature and carbon content in high-purity Fe-C alloys. A supporting theoretical study of the stereology of grain boundary allotriomorphs was simultaneously conducted. The experimental study showed that at small undercoolings the measure parabolic rate constants for the thickening and lengthening of the allotriomorphs are as much as an order of magnitude less than those calculated assuming carbon diffusion-control; with increased undercooling, the measured growth rates approached more closely, but did not quite reach, those calculated. This discrepancy was ascribed to the presence of a proportion of partially coherent facets at the boundaries of the allotriomorphs. It was concluded that the experimental method used during this investigation is the most satisfactory one for determining the true growth kinetics of grain boundary allotriomorphs presently available. GRA

N77-21229# American Univ., Washington, D.C. Dept. of Chemistry.
CHEMICAL EFFECTS IN THE CORROSION OF ALUMINUM AND ALUMINUM ALLOYS: A BIBLIOGRAPHY Technical Progress Report
B. W. Samuels, C. M. Dacres, and R. T. Foley Oct. 1976 42 p
(Contract N00014-75-C-0799; NR Proj. 036-106)
(AD-A031667; TR-4) Avail: NTIS HC A03/MF A01 CSCL 11/6

A bibliography of the literature on aluminum corrosion for the years 1968 - 1975 is reported. Special attention is given to chemical effects in corrosion and inhibitors for aluminum corrosion. Author (GRA)

N77-21230# Connecticut Univ., Storrs. Dept. of Metallurgy.
FATIGUE CRACK PROPAGATION IN TITANIUM ALLOYS Annual Report, 1 Jul. 1975 - 30 Jun. 1976
A. J. McEvily 30 Jul. 1976 19 p
(Grant AF-AFOSR-2703-74; AF Proj. 9782)
(AD-A031360; UC-MET-2-76; AFOSR-76-1129TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

This research has involved studies of fatigue crack initiation as well as fatigue crack propagation. Principal findings have been that subsurface fatigue cracks can be initiated in forgings of this titanium alloy when the alpha-phase size is of the order of 10 micron, a size which can be present in large forgings. This mode of fatigue crack initiation can have a deleterious effect on long-life fatigue performance at positive mean stress levels. Results of the fatigue crack propagation studies have shown that the rate of fatigue crack growth in air and in vacuum can be analyzed in terms of a modified continuum mechanics treatment of fatigue crack growth based upon the concept that the fatigue crack growth increment per cycle is related to the extent of crack opening displacement. GRA

N77-21231# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
SURFACE CHARACTERIZATION OF TITANIUM AND TITANIUM ALLOYS. PART 3: EFFECT ON Ti (c.p.) AND Ti-8Mn OF LABORATORY CHEMICAL TREATMENTS Interim Report, Jul. 1975 - Apr. 1976
William L. Baun, Neil T. McDevitt, and James S. Solomon Sep. 1976 63 p refs
(AD-A032954; AFML-TR-76-29-Pt-3) Avail: NTIS HC A04/MF A01 CSCL 11/6

This investigation is part three of a program which looks at the effects of surface treatments on surface chemistry and morphology of titanium and titanium alloys. This part discusses the effects of six laboratory surface treatments on titanium, commercially pure and Ti-8Mn alloys. GRA

N77-21232# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
CRACK CLOSURE AND FATIGUE CRACK GROWTH IN 2219-T851 ALUMINUM ALLOY Interim Report, 15 Jun. 1975 - 14 Jun. 1976
K. D. Unangst, T. T. Shih, and R. P. Wei Aug. 1976 77 p refs
(Grant AF-AFOSR-2857-75; AF Proj. 9782)
(AD-A033082; IFSM-76-77; AFOSR-76-1247TR) Avail: NTIS HC A05/MF A01 CSCL 11/6

The effects of specimen thickness, stress ratio (R), and maximum stress intensity factor (K sub max) on crack closure (or opening) and on fatigue crack growth kinetics were studied using a 2219-T851 aluminum alloy. The crack length and the occurrence of crack closure were measured by an electrical potential method. The experimental work was carried out within the framework of linear-elastic fracture mechanics. GRA

N77-21233# Martin Marietta Labs., Baltimore, Md.
GRAIN BOUNDARY SEGREGATION AND STRESS CORROSION CRACKING OF ALUMINUM ALLOYS Interim Report
J. A. S. Green, R. K. Viswanadham, T. S. Sun, and W. G. Montague Nov. 1976 30 p refs
(Contract N00014-74-C-0277)
(AD-A033096; MML-TR-76-84c) Avail: NTIS HC A03/MF A01 CSCL 11/6

Auger electron spectroscopy and chemical depth profiling by argon sputtering were employed to obtain the grain boundary segregation profiles of various aluminum alloys. Samples of both commercial (7075, 7050, and 7049) and high purity alloys based on the Al-Zn-Mg ternary in different heat treatments were examined following in situ fracturing in the spectrometer. Segregation profiles indicate that the grain boundaries in these alloys are considerably enriched in Mg and Zn. In commercial alloys, however, the grain boundaries are depleted in the minor elements Fe, Cu, and Si. AES spectra of oxide films formed on Al-Zn-Mg alloys indicate that the enhanced segregation along the grain boundaries results in a film rich in Mg. It is postulated that incorporation of extensive amounts of these alloying elements into the film renders it less protective and leads to enhanced hydrogen entry and embrittlement by stress corrosion cracking. Author (GRA)

N77-21234# Rhode Island Univ., Kingston. Dept. of Ocean Engineering.
OPTIMIZATION OF THE ELECTROCHEMICAL HYDROGEN PERMEATION TECHNIQUE Final Report
R. Heidersbach Oct. 1976 51 p refs
(Grant DAAG29-76-G-0070)
(AD-A033597; ARO-13564.1-R-MS) Avail: NTIS HC A04/MF A01 CSCL 11/6

An electrochemical hydrogen permeation cell incorporating improved geometrical and other design features has been developed and tested. Results on iron samples indicate the need for palladium coating of hydrogen entry and exit surfaces if internal transport rates of hydrogen in the metal are to be determined. Electrodeposition and vapor deposition of palladium coatings have been shown to be unsatisfactory. Samples vacuum coated by ion deposition in an argon-ion plasma at reduced pressure proved to be satisfactory. Results obtained in this study indicate that substantially longer times to obtain steady states are needed than have previously been reported by some researchers. This would indicate that hydrogen transport rates would be lower than have been reported. Author (GRA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N77-21235# Lockheed Missiles and Space Co., Palo Alto, Calif.
PROCESSING OF THE EXPERIMENTAL RESULTS ON POLYMER MATERIALS BY MEANS OF THE NONLINEAR THEORY OF ANISOTROPIC MEDIA
I. M. Tiuneeva [1976] 7 p refs Transl. into ENGLISH from Uprugost' i Neuprugost' (Moscow), no. 4, 1975 p 190-198
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Ill. 60616

A theory of the plasticity of anisotropic media with hardening is proposed. This theory has a quadratic form of the plasticity condition and a plastic potential hypothesis but has no assumption about the incompressibility of the material and the lack of hardening. For an isotropic body it agrees with the Il'iushin theory of small elastic-plastic strains. This theory is applicable to the investigation of the strain processes in both elastic-plastic and nonlinearly elastic anisotropic media. Author

N77-21236*# Science Applications, Inc., La Jolla, Calif.
DEVELOPMENT OF FLAME RESISTANT TREATMENT FOR NOMEX FIBROUS STRUCTURES Interim Technical Report, 3 Nov. 1975 - 31 Mar. 1977
Madeline S. Toy 31 Mar. 1977 25 p refs
(Contract NAS9-14827; SAI Proj. 1-108-00-546)
(NASA-CR-151247; SAI-76-546-SV) Avail: NTIS HC A02/MF A01 CSCL 11E

Flame resistant fibrous materials for space shuttle application were developed through chemical modification of commercially available aromatic polyamide fibrous products. The new surface treatment was achieved in the laboratory by ultraviolet activation of the fabric in the presence of fluoroolefin monomers and a diluent gas. The monomers grafted under these conditions provide

the improved properties of the fabric in flame resistance, chemical inertness, and nonwettability without the sacrifice of color or physical properties. The laboratory reaction vessel was scaled-up to a batch continuous process, which treats ten yards of the commercial width textiles. The treated commercial width Nomex (HT-10-41) from the scaled-up reactor is self-extinguishing in an oxygen-enriched environment, water-repellent, soft, silky, and improved in chemical resistance. Unlike most textile processes, the grafting unit operates under dry conditions and no chemical by-products have to be washed out of the finished product.
Author

N77-21237# Lockheed Missiles and Space Co., Palo Alto, Calif.
PREDICTION OF THE CREEP OF POLYMER MATERIALS DURING THE RANDOM PROCESSES OF A CHANGE IN THE LOADS AND THE TEMPERATURE-MOISTURE CONDITIONS OF THE ENVIRONMENT. 1: RANDOM NONSTATIONARY ONE-DIMENSIONAL LOADING
G. A. Andrikson, Z. V. Kalnroze, and Iu. S. Urzhumtsev [1976] 6 p refs Transl. into ENGLISH from Mekh. Polim. (USSR), v. 2, 1976 p 214-219
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The possibility of using methods of the theory of random processes to predict the creep of polymer materials in the class of rheologically simple bodies is shown for a random nonstationary stress effect. The nonstationary random stress is simulated by a one-dimensional Gaussian process with zero mathematical expectation and nonstationary variance. The creep is predicted under the mentioned conditions by using an electronic computer and relying on test data obtained for uniaxial tension of a fabric epoxy phenolic glass-plastic at a 45 deg angle to the bonding axes.
Author

N77-21238# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF THE TEMPERATURE AND MOISTURE ON THE CREEP OF POLYMER MATERIALS. 1: ONE-DIMENSIONAL TENSION UNDER STATIONARY TEMPERATURE-MOISTURE CONDITIONS
R. D. Maksimov, E. A. Sokolov, and V. P. Mochalov [1976] 7 p refs Transl. into ENGLISH from Mekh. Polim. (USSR), v. 3, 1975 p 393-399
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Creep tests were conducted on the polyester resin PN-3 under one-dimensional tension in the linear domain of the stress-strain relation and different fixed values of the material temperature and moistness. The dependence of the material conditionally-instantaneous elasticity and creep characteristics on the temperature and moisture is determined. It is established that the temperature-moisture-time analogy can be conserved for creep under different fixed temperature-conditions.
Author

N77-21239# Sandia Labs., Albuquerque, N.Mex.
ADHESIVES FOR HYBRID MICROCIRCUITS
J. A. Silva Aug. 1976 22 p
(Contract E(29-1)-789)
(SAND-76-0179) Avail: NTIS HC A02/MF A01

The results of the characterization of 12 adhesives that were selected as being representative of adhesives used in the assembly of hybrid microcircuits are presented. Test procedures and results are presented in detail, and a material properties chart is supplied to assist the user in the selection and specification of the best adhesive for his application.
ERA

N77-21240# California Univ., Livermore. Lawrence Livermore Lab.
DIELECTRIC COATINGS ON METAL SUBSTRATES
S. S. Glaros, P. Baker, and D. Milam 27 Jul. 1976 8 p refs Presented at 1976 Symp. on Opt. Mater. for High Power Lasers, Boulder, Colo., 15-17 Jul. 1976
(Contract W-7405-eng-48)
(UCRL-78249; Conf-760724-4) Avail: NTIS HC A02/MF A01

Large aperture, beryllium substrate-based mirrors were used to focus high intensity pulsed laser beams. Finished surfaces have high reflectivity, low wavefront distortion, and high laser damage thresholds. The development of a series of metallic coatings, surface finishing techniques, and dielectric overcoatings to meet specified performance requirements is described. Beryllium substrates were coated with copper, diamond-machined to within 5 micro-inches to final contour, nickel plated, and abrasively figured to final contour. Bond strengths for several bonding processes are presented. Dielectric overcoatings were deposited on finished multimetallic substrates to increase both reflectivity and the damage thresholds. Coatings were deposited using both high and low temperature processes which induce varying stresses in the finished coating substrate system. Data are presented to show the evolution of wavefront distortion, reflectivity, and damage thresholds throughout the many steps involved in fabrication.
ERA

N77-21241# Bosch (Robert) G.m.b.H., Gerlingen (West Germany).
PLASMA SPRAYED SOLID LUBRICANT FILMS FOR OIL- AND GREASEFREE BEARINGS. STUDIES OF CHALCOGENIDE FILMS AND TESTING OF SLIDE COUPLES UNDER NORMAL CONDITIONS AND IN VACUUM Final Report
Kuno Kirner Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1976 101 p In GERMAN; ENGLISH summary
(Contracts BMFT-RFT-3772; GfW-RV-11-TB-4/72-Z)
(BMFT-FB-W-76-16) Avail: NTIS HC A06/MF A01; ZLDI, Munich DM 21

Solid lubricant films of molybdenum disulfide, columbium selenide, columbium telluride, and of compounds of solid lubricants and metals such as silver + molybdenum disulfide, silver + tungsten disulfide, as well as wear resistant oxides and oxides + metals were plasma sprayed. A coated ring was turned against a fixed uncoated one, in a special high vacuum - high temperature - wear - and frictions-test machine. Friction coefficient, temperature, and slide way were recorded. The best results were obtained with molybdenum disulfide coatings having friction coefficients near 0.1 with best values appr. 0.05 and slide ways up to 141,000 m. Less favorable were the coatings on the base of the selenides and worse the coatings with tellurides and oxides. Suitable results with friction coefficients appr. 0.1 were also obtained with compounds of molybdenum disulfide and silver. Compared with pure molybdenum disulfide coatings these compounds have a higher strength, and should be useful bearing materials for vacuum and normal environments. The spray powders, and the coatings (before and after the tests) were also evaluated by metallography.
Author (ESA)

N77-21242# Rutgers - The State Univ., New Brunswick, N. J. High Pressure Research Lab.
HIGH PRESSURE X-RAY STUDIES OF POLYMERS. 1: PRESSURE CALIBRATION FOR THE DIAMOND ANVIL-CELL IN THE RANGE 0-15 KBARS
T. P. Sham, B. A. Newman, and K. D. Pae 15 Oct. 1976 17 p refs Submitted for publication
(Contract N00014-75-C-0540; NR Proj. 356-564)
(AD-A031797; TR-6) Avail: NTIS HC A02/MF A01 CSCL 07/4

Pressure-volume data for hexamethylene tetramine up to 7 kbars was obtained using a dilatometer, combined with some data obtained by Bridgeman, and the square for pressures up to 15 kbars. A good fit was obtained, the constants.
Author (GRA)

N77-21243# Rutgers - The State Univ., New Brunswick, N. J. High Pressure Research Lab.
HIGH PRESSURE X-RAY STUDIES OF POLYMERS. 3: VARIATION OF PRESSURE WITH TEMPERATURE IN THE DIAMOND-ANVIL CELL
B. A. Newman, K. D. Pae, and T. P. Sham 15 Oct. 1976 13 p refs Submitted for publication
(Contract N00014-75-C-0540; NR Proj. 356-564)
(AD-A031798; TR-7) Avail: NTIS HC A02/MF A01 CSCL 07/4

The pressure in the diamond cell X-ray camera was measured as a function of temperature. Contrary to the assumption of previous workers, this pressure was not found to be constant with increased temperatures, the different thermal expressions of sample, pressure medium, diamonds and retaining ring combining to produce pressure increases of 100 % over a 100 C temperature range. In view of the fact that the diamond cell

is frequently used to study the crystallization of polymers at high pressure, it should be noted that changes in pressure are equivalent to changes in the degree of supercooling. Since the crystallization kinetics and resulting polymer morphology are affected critically by even small changes in the degree of supercooling, conclusions drawn from investigations where the pressure was not directly measured should be regarded with caution. Author (GRA)

N77-21244# Rutgers - The State Univ., New Brunswick, N. J. High Pressure Research Lab.

HIGH PRESSURE X-RAY STUDIES OF POLYMERS. 3: PHASE TRANSFORMATION OF POLYETHYLENE

K. D. Pae, B. A. Newman, and T. P. Sham 15 Oct. 1976 18 p refs Submitted for publication

(Contract N00014-75-C-0540; NR Proj. 356-564)

(AD-A031799; TR-8) Avail: NTIS HC A02/MF A01 CSCL 07/4

A systematic study was made on polyethylene at high pressures and elevated temperatures using X-ray diffraction. Polyethylene with an initial chain-folded morphology and the orthorhombic crystal structure did not transform to any other phase before melting at temperature and pressure. Crystallization, however, at high pressures producing extended-chain crystals gave rise to either a new crystal phase, probably hexagonal or the orthorhombic phase depending on the crystallization conditions. A reversible solid-state phase transformation was observed between the orthorhombic and hexagonal phases. None of the previous interpretations put forward to account for the high pressure D.T.A. and dilatometric studies of polyethylene, would appear to be appropriate in view of these findings. Author (GRA)

N77-21245# New York State Dept. of Transportation, Albany. Engineering Research and Development Bureau.

TESTING OF SELECTED BEADS FOR TRAFFIC PAINTS Interim Report

Earl D. McNaught and Kenneth C. Hahn May 1976 31 p refs

(PB-260872/7; NYSDOT-ERD-76-RR-36; FHWA-RD-M-0317; IR-6) Avail: NTIS HC A03/MF A01 CSCL 11C

Beads for traffic paint were evaluated under field conditions on longitudinal paint stripes applied by a standard state paint truck and crew. Types tested were the state's standard bead, uniformly graded flotation beads, state standard beads with flotation treatment, and polyester beads with and without an anti-ultraviolet light treatment. All were applied at three different rates to both asphalt and portland cement concrete pavements. Performance was rated until substantial failure occurred after three months, using a vehicle mounted photocell device, subjective visual ratings, and close up photography. Application rate does not appear to influence brightness to the degree expected, but this was attributed to bead distribution problems caused by a poorly designed dispenser. GRA

N77-21246# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

REACTIVE PLASTICIZERS FOR HIGH TEMPERATURE QUINOXALINE THERMOPLASTICS Final Technical Report, Mar. 1975 - Oct. 1975

R. F. Kovar (Dayton Univ. Res. Inst., Ohio), G. F. L. Ehlers, and F. E. Arnold Jun. 1976 31 p refs

(AF Proj. 7340)

(AD-A031328; AFML-TR-76-28) Avail: NTIS HC A03/MF A01 CSCL 11/9

This report is concerned with a novel approach to the processing of high temperature thermoplastics. A series of bis(ethynylquinoxaline) monomers were prepared to demonstrate the feasibility of using reactive plasticizers in the processing of polyphenylquinoxaline thermoplastics. The monomers were prepared by the reaction of 4(3-ethynylphenoxy)-o-phenylenediamine with various aromatic 1,2-dicarbonyl compounds in m-cresol. The reactive plasticizer lowers the effective softening point of the thermoplastic resin during processing and then becomes dormant by reacting with itself or the host thermoplastic. Mixtures of monomer and thermoplastic were studied with respect to compatibility, Tg depression, and plasticizer deactivation. Author (GRA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N77-21247*# Utah Univ., Salt Lake City. Dept. of Civil Engineering.

MEASURED PROPERTIES OF PROPELLANT FOR SOLID ROCKET BOOSTER OF ONE-EIGHTH SCALE DYNAMIC SHUTTLE MODEL Final Report

William L. Hufferd Feb. 1977 65 p refs Revised.

(Grant NsG-1113)

(NASA-CR-144938; UTEC-CE-75-178) Avail: NTIS HC A04/MF A01 CSCL 21I

Static and dynamic material property tests were conducted on inert UTI-610 propellant to obtain basic mechanical response data for use in analysis of the one-eighth scale models of the Space Shuttle SRB being dynamically tested at the Langley Research Center. Author

N77-21248*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

VAPOR INGESTION IN A CYLINDRICAL TANK WITH A CONCAVE ELLIPTICAL BOTTOM

Andrew Klavins 26 Feb. 1974 19 p refs

(Contract NAS3-17798)

(NASA-CR-135007; LMSC-D386845) Avail: NTIS HC A02/MF A01 CSCL 21I

An approximate analytical technique is presented for estimating the liquid residual in a tank of arbitrary geometry due to vapor ingestion at any drain rate and acceleration level. The bulk liquid depth at incipient pull-through is defined in terms of the Weber and Bond numbers and two functions that describe the fluid velocity field and free surface shape appropriate to the tank geometry. Numerical results are obtained for the Centaur LH2 tank using limiting approximations to these functions. Author

N77-21249# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.

EVALUATION OF A MECHANICAL PROPERTY TEST FOR SMALL SAMPLES OF PLASTIC BONDED EXPLOSIVES, APRIL - JUNE 1976

L. C. Myers and H. D. Johnson 1976 13 p ref Sponsored in part by ERDA

(Contract DA-11-173-AMC-487(A))

(MHSMP-76-30P) Avail: NTIS HC A02/MF A01

The indirect tension test was evaluated to determine its feasibility for measurements of the mechanical properties of plastic bonded explosives (PBX) samples from coupon compatibility tests and small scale tests used to evaluate new binders for explosives. Tests were run on LX-09, LX-04, LX-14 and RX-03-BB to determine if the dynamic range of the test would be adequate for these materials. The maximum stress ranged from 623 to 4182 kPa for these materials. The effect of test temperature on LX-09 and RX-03-BB was investigated to determine the temperature control required for the test. Tests were conducted to determine if both isostatically and mechanically pressed PBX parts could be used with this test. The data from these series of tests indicate that the indirect tension test will provide useful information about the mechanical strength of PBX's. ERA

N77-21250# Sandia Labs., Albuquerque, N.Mex.

DEVELOPMENT OF A MINIATURE PYROTECHNIC TORCH

J. R. Craig Sep. 1976 33 p refs

(Contract E(29-1)-789)

(SAND-76-0293) Avail: NTIS HC A03/MF A01

A miniature electrically initiated pyrotechnic torch was developed for an application that required burning through a copper or steel barrier and igniting a pyrotechnic-diallyl phthalate material located in close proximity. The general requirements which were used as design objectives and the design concept which evolved are described. Significant parameter studies leading to the final design are discussed in detail. Development test

data show that the high energy composite pyrotechnic which is being used to provide a jet flame output for approximately one second has a fast burn rate and is both pressure and temperature sensitive. The maximum barrier thickness through which the torch will burn was found to be 0.95 mm for copper and 1.5 mm for steel. ERA

N77-21251# Technological Lab. RVO-TNO, Rijswijk (Netherlands).

THE INFRARED SPECTROMETRIC ANALYSIS OF GASES PRODUCED IN VACUUM STABILITY TESTS OF GUNPOWDERS AND EXPLOSIVES [DE INFRAROOD--SPEKTROMETRISCHE ANALYSE VAN GASSEN WELKE ONSTAAN BIJ DE VACUUMSTABILITEITSTEST VAN KRUITEN EN SPRINGSTOFFEN]

H. L. Barreveld 28 Jul. 1976 14 p refs In DUTCH
(Contract A70/KL/057)
(TL-1976-9; TDCK-68047) Avail: NTIS HC A02/MF A01

An infrared spectroscopic analysis method for the gases carbon monoxide, carbon dioxide, nitric oxide, nitrous oxide, and nitrogen dioxide, produced in vacuum stability tests following compatibility tests of explosives stored together with other materials such as polymers, is described. ESA

N77-21252# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.

REDUCED-SMOKE SOLID PROPELLANT COMBUSTION PRODUCTS ANALYSIS. DEVELOPMENT OF A MICROMOTOR COMBUSTOR TECHNIQUE Interim Report, 1 Feb. - 1 Jul. 1976

Berge B. Goshgarian Oct. 1976 36 p refs
(AD-A032152; AFRPL-TR-76-69) Avail: NTIS
HC A03/MF A01 CSCL 21/9

A low-cost micromotor combustor technique has been devised to support the development of reduced-smoke solid propellant formulations. The technique includes a simple, reusable micromotor capable of high chamber pressures, a combustion products collection system, and procedures for analysis of combustion products. Analytical results for non-condensible combustion products compared favorably with equilibrium calculations. Analysis of solid combustion products revealed that all of the zirconium carbide stability additive in the formulation was oxidized to zirconium oxide, however, the graphite additive was not completely oxidized. Author (GRA)

N77-21253# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

VISCOSITY MEASUREMENTS OF POTENTIAL HIGH DENSITY HYDROCARBON FUEL BLENDS Final Report, Dec. 1973 - Dec. 1974

Herbert R. Lander, Jr. and Alfred E. Strouse Jun. 1976 133 p refs
(AD-A031902; AFAPL-TR-76-17) Avail: NTIS
HC A07/MF A01 CSCL 21/4

The principle problems associated with the use of RJ-5 (Shelldyne-H) as a missile fuel is its high viscosity, particularly at 0 F and below. Chemically, this material can be described as the hydrogenated dimer of norbornadiene (HNBD). Using the Model 17 Weissenberg Rheogoniometer, the viscosity of pure RJ-5 and blends of RJ-5 and other hydrocarbons was determined over a temperature range from -65 F to - 70 F. The hydrocarbons evaluated as viscosity improvers when added to Shelldyne-H include toluene, JP-4, methylcyclohexane, tetralin, decalin, RJ-4 (tetrahydro-methylcyclopentadiene dimer), and isobutylbenzene. The concentrations studied were 5, 10, 25, and 35 and 50 weight percent diluent in RJ-5. Toluene blends were found to be the most effective in reducing low viscosity while retaining volumetric heating values at significantly high levels. It is concluded that considerable progress is possible in the high density missile fuel area through the blending of hydrocarbon components. Present high density fuels, such as RJ-5, can be tailored to yield fuels with properties which are more adaptable to suitable system designs for low temperature application and yet have significantly more volumetric energy (higher density) than conventional hydrocarbon fuels. Author (GRA)

N77-21254# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.

TEST AND EVALUATION OF COMMERCIAL AND MILITARY STANDARD FILTER/COALESCER ELEMENTS AT LOWERED TEMPERATURES Final Report, Jan. - Mar. 1975

William R. Williams May 1976 41 p
(DA Proj. 1G7-62708-D-506)
(AD-A031906; USAMERDC-2176) Avail: NTIS
HC A03/MF A01 CSCL 21/4

Tests were performed on military standard and commercial filter/coalescer elements to compare their ability to coalesce suspended water from hydrocarbon fuels at temperatures approximately 40 to 65 F. Test fuels were turbine fuel, JP-5, and diesel fuel, No. 2. Comparison tests of two manufacturers of water-in-fuel monitors (turbidimeters) were performed. Charts showing correlations were prepared and formulas were derived. Author (GRA)

N77-21255# California Univ., Irvine.

TOXIC HAZARDS RESEARCH UNIT ANNUAL TECHNICAL REPORT 1976 Final Report, Jun. 1975 - May 1976

J. D. MacEwen and E. H. Vernot Wright Patterson AFB, Ohio AMRL Sep. 1976 181 p refs
(Contract F33615-76-C-5005)
(AD-A031860; AMRL-TR-76-57) Avail: NTIS
HC A09/MF A01 CSCL 21/4

The research programs of the Toxic Hazards Research Unit (THRU) for the period of June 1975 through May 1976 are reviewed in this report. Chronic toxicity experiments were conducted using JP-4, RJ-4 (perhydromethylcyclopentadiene) and RJ-5 (reduced dimers of bicyclopentadiene) jet fuels. Studies were carried out on the oncogenicity of hydrazine, 1,1- dimethylhydrazine and coal tar aerosol. The hepatotoxicity of dimethylnitrosamine was investigated by the oral route and, in conjunction with 1,1-dimethylhydrazine, by the inhalation route. Acute rodent toxicities of hydrogen chloride, hydrogen fluoride and their mixtures with and without alumina dust were determined. The acute effects of tetranitromethane, the isomeric nitrotoluenes and methyl nitrate by various routes of administration were examined. Oral, cutaneous, and inhalation toxicity determinations and skin corrosion studies were made on a number of transportable chemical agents. Author (GRA)

N77-21256# Picatinny Arsenal, Dover, N.J.

RESPONSE OF PRIMARY EXPLOSIVES TO GASEOUS DISCHARGES IN AN IMPROVED APPROACHING-ELECTRODE ELECTROSTATIC SENSITIVITY APPARATUS

Maurice S. Kirshenbaum Oct. 1976 59 p refs
(DA Proj. 1W6-62617-AH79)
(AD-A033118; PA-TR-4955) Avail: NTIS HC A04/MF A01 CSCL 19/1

This report describes an improved, approaching-needle electrostatic sensitivity apparatus as well as the instrumentation used for measuring time-dependent gaseous discharge characteristics. It is shown that the addition of resistances in series with the gap changes the nature of the discharge as found previously for the fixed-gap apparatus. The energy delivered from the storage capacitor to the gap is 3-6% for an arc discharge and 15-25% for a spark discharge. The initiation of basic lead styphnate, RD1333 lead azide, and tetracene by gaseous discharge is a strong function of the energy delivery rate. The threshold initiation energy values were considerably less in the spark mode (long duration discharge) than in the oscillatory or arc modes (short duration discharges). The ranking of the sensitivity of these three primary explosives did not vary with the mode of discharge as found previously for the fixed-gap, parallel-plate apparatus. To meet the need for a single, standardized electrostatic sensitivity apparatus and test method able to distinguish between primary, booster or main charge explosives and to rank the sensitivity of explosives, the approaching-needle apparatus used in this study, with slight modifications, is proposed to the Joint Service Committee for adoption as a Tri-Service standard. Author (GRA)

N77-21257# Federal Energy Administration, Washington, D. C. Office of Energy Information and Analysis.

PROJECTED NATURAL GAS CURTAILMENTS AND POTENTIAL NEEDS FOR ADDITIONAL ALTERNATE FUELS, 1976-1977 HEATING SEASON

Albert Bass Nov. 1976 76 p refs
(PB-260535/0; FEA/B-76/463) Avail: NTIS

HC A05/MF A01 CSCL 21D

Impact was reflected in the availability of alternate fuels or emergency gas volumes which can be substituted for natural gas in the event of a shortage. The monthly data enabled the determination of additional gas curtailments projected for the 1976-1977 heating season. All projections and findings in the report related to deliveries, curtailments, and needs for alternate fuels during the 1976-1977 winter are based on assumptions of normal winter weather conditions. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N77-21258*# Weiner Associates, Inc., Lutherville, Md.
A STUDY OF NASA OCCUPATIONAL INJURIES AND PROPERTY DAMAGE AT GODDARD SPACE FLIGHT CENTER, LANGLEY RESEARCH CENTER AND HEADQUARTERS Technical Report, 1971 - 1976
Dec. 1976 121 p refs
(Contract NASw-2903)
(NASA-CR-152659; WAI-TR-76.12.1) Avail: NTIS HC A06/MF A01 CSCL 13L

Analysis of NASA's accident/injury/illness and health data was performed. The analysis included: (1) an on-site study of the existing data; (2) evaluation of the findings to develop criteria for the subsequent implementation of safety and health standards; (3) preparation of a graphical loss control assessment; and (4) recommendations to reduce accident rates. I.M.

N77-21259*# Mathtech, Inc., Princeton, N. J.
METHODS FOR THE EVALUATION OF ALTERNATIVE DISASTER WARNING SYSTEMS Technical Report, 15 Jan. 1976 - 15 Feb. 1977
Carson E. Agnew, R. J. Anderson, Jr., and W. N. Lanen Feb. 1977 227 p refs
(Contract NASw-2871)
(NASA-CR-152661) Avail: NTIS HC A11/MF A01 CSCL 13L

For each of the methods identified, a theoretical basis is provided and an illustrative example is described. The example includes sufficient realism and detail to enable an analyst to conduct an evaluation of other systems. The methods discussed in the study include equal capability cost analysis, consumers' surplus, and statistical decision theory. Author

N77-21260*# Mathtech, Inc., Princeton, N. J.
METHODS FOR THE EVALUATION OF ALTERNATIVE DISASTER WARNING SYSTEMS. EXECUTIVE SUMMARY
Carson E. Agnew, R. J. Anderson, Jr., and W. N. Lanen 1977 24 p
(Contract NASw-2871)
(NASA-CR-152660) Avail: NTIS HC A02/MF A01 CSCL 13L

Methods for estimating the economic costs and benefits of the transmission-reception and reception-action segments of a disaster warning system (DWS) are described. Methods were identified for the evaluation of the transmission and reception portions of alternative disaster warning systems. Example analyses, using the methods identified were performed. Author

N77-21261*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPECIFIC COOLING CAPACITY OF LIQUID NITROGEN
Robert A. Kilgore and Jerry B. Adcock 14 Feb. 1977 19 p refs
(NASA-TM-X-74015) Avail: NTIS HC A02/MF A01 CSCL 20L

The assumed cooling process and the method used to calculate the specific cooling capacity of liquid nitrogen are described, and the simple equation fitted to the calculated specific cooling capacity data, together with the graphical form calculated values of the specific cooling capacity of nitrogen for stagnation temperatures from saturation to 350 K and stagnation pressures from 1 to 10 atmospheres, are given. Author

N77-21262# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION AND DEVELOPMENT OF THE PROCESS OF EVACUATING VESSELS WITH MULTILAYER-VACUUM INSULATION
M. G. Kaganer, Iu. N. Fetisov, and L. M. Iurchik [1976] 5 p refs Transl. into ENGLISH from Khimich. i Neftian. Mashinostroenie (USSR), v. 10, 1976 p 20-22
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The interdependence between the fundamental parameters (magnitude of the degassing, pressure, heating temperature, duration of evacuation) which characterize the process of evacuating industrial vessels with multilayer-vacuum insulation was determined. The degassing characteristics of different multilayer-vacuum insulation compositions and of the separate components, as well as of the activated SKT carbon used to absorb the residual gases in the insulation cavity, were determined first as a function of a different initial preparation and operating temperature. Author

N77-21263# Bendix Corp., Kansas City, Mo.
FACE-UP BONDING OF BEAM LEAD DEVICES
A. O. Bendure and W. A. Piper Aug. 1976 35 p refs Revised
(Contract E(29-1)-613)
(BDX-613-1462-Rev; PDO-6984749) Avail: NTIS HC A03/MF A01

An SCR-diode combination, packaged in beam leaded device form, was thermocompression bonded by its beams and soldered by its body to a gold metallized ceramic substrate. The purpose of the face-up bonding was to provide improved heat dissipation from the device. There was little difference in thermal admittance between devices with or devices without solder flow. Gold-tin provides much higher thermal admittance, although the lead-indium provides a very closely controlled distribution. The lead-indium preforms are cheaper and easier to use in a manufacturing environment. ERA

N77-21264# Argonne National Lab., Ill.
LIQUID NITROGEN FIRE EXTINGUISHING SYSTEM TEST REPORT
J. A. Beidelman 4 May 1972 9 p
(Contract W-31-109-eng-38)
(ANL-72-XX-9) Avail: NTIS HC A02/MF A01

The feasibility of using liquid nitrogen as a fire-extinguishing agent for certain types of metal fires was demonstrated to provide data and experience appropriate to the design of a second series which will test the applicability of this technique to plutonium fires and which will develop more detailed operating information and permit more precise measurement of test parameters-oxygen depletion rates and equilibrium concentrations, temperature effects, and nitrogen pressures, flow rates, spray methods and patterns. The test series was directed specifically toward extinguishment of metal fires occurring in well-confined areas, and was not intended to be representative of any larger classification. Fires of several types were tested, e.g., magnesium, mixed magnesium and zirconium, sodium and cerium. ERA

N77-21265# Leybold-Heraeus G.m.b.H., Hanau/Main (West Germany).
STUDY FOR THE MODIFICATION OF A MULTIFOIL RESISTANCE HEATED VACUUM FURNACE FOR MATERIAL SCIENCE EXPERIMENTS IN SPACE, VOLUME 1
1976 106 p ref 2 Vol.
(Contract ESA-SC/73-HQ)
(ESA-CR(P)-900-Vol-1) Avail: NTIS HC A06/MF A01

A multifoil resistance heated high temperature vacuum furnace and its modifications are described for use onboard Spacelab. The required temperature range extends from room temperature to 2400 C. The mechanical and ultrasonic positioning devices are taken into account. Preliminary tests resulted in a furnace design having a power loss of 200 W and air cooling. The temperature of the operating chamber is 1250 C under vacuum operation. Using an inert gas, atmosphere temperature of 450 C (under 500 mm Hg helium) and 800 C (under 500 mm Hg argon) are attained. ESA

N77-21266# National Bureau of Standards, Washington, D. C.
DIMENSIONS (NBS). VOLUME 60, NUMBER 10: WEIGHTS AND MEASURES: NEW CHALLENGES IN TODAY'S MARKETPLACE Monthly Report
Oct. 1976 27 p refs
(PB-248904/10; NBS-DIM-60-10-Vol-60-No-10; LC-25-26527) Avail: NTIS MF A01; SOD HC as C13 CSCL 05B

The monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by bureau management, and a listing of NBS publications. The table of contents for the current issue is: weights and measures--new challenges in today's marketplace; the money side of the lead paint problem; the consumer comes face-to-face with the computer; a primer on temperature scales--centrigrade/Celsius, fahrenheit, Kelvin; monitoring the exchange of power--new calibration system for electrical industries; highlights; two new glass standards; and computer program for heating/cooling loads in buildings available. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N77-21267* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD OF LOCATING PERSONS IN DISTRESS Patent
Wilford Eugene Sivertson, Jr., inventor (to NASA) Issued 19 Apr. 1977 5 p Filed 27 Feb. 1976 Supersedes N76-18315 (14 - 09, p 1107)
(NASA-Case-LAR-11390-1; US-Patent-4,019,179; US-Patent-Appl-SN-662176; US-Patent-Class-343-5MM; US-Patent-Class-340-5H; US-Patent-Class-343-5CM; US-Patent-Class-343-18B) Avail: US Patent Office CSCL 17I

A method for locating any person in distress in a selected area on the surface of the earth who has deployed passive radio frequency (RF) reflectors in a predetermined arrangement is analyzed. A first transparency is made in the spatial frequency domain of an image of said predetermined arrangement of said RF reflectors. The said selected area of the surface of the earth is scanned by means of a side-looking radar, on board a satellite or aircraft, to produce radar images. Second transparencies in the conventional image domain are produced from the radar images. It is then determined from the first and second transparencies, by means of complex spatial filtering.
Official Gazette of the U.S. Patent Office

N77-21268 British Broadcasting Corp., Kingswood (England). Engineering Div.
LF AND MF PROPAGATION: A STUDY OF SKY-WAVE FIELD-STRENGTH VARIATION
P. Knight Mar. 1977 17 p refs
(BBC-RD-1977/12) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

LF and MF sky waves vary in strength during periods which may be as short as a minute or as long as 11 years; this range includes day-to-day, diurnal, seasonal, and solar cycle variations. A detailed study has been made of all that is known about LF and MF sky wave field strength variation and this has been supplemented by further analysis of measured data. Author

N77-21269 British Broadcasting Corp., Kingswood (England). Engineering Div.
A BAND 2 FERRITE AERIAL UNIT FOR PORTABLE RECEIVERS
R. D. C. Thoday Mar. 1977 6 p
(BBC-RD-1977/11) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The whip aerial needed for good reception at VHF is a drawback to the use of portable sound receivers. A small VHF aerial unit has been built using a recently developed ferrite rod which is commercially available at low cost. The unit has been incorporated inside the cabinet of a simple VHF domestic portable receiver. It provides adequate signal pick-up and has the advantage of being less disturbed by the movement of people near the receiver. Author

N77-21270 British Broadcasting Corp., Kingswood (England). Engineering Div.
AN EXPERIMENTAL DIGITAL PICTURE STORE
R. Walker and G. W. McNally Mar. 1977 10 p
(BBC-RD-1977/9) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The design is an outline of a 3.6 Mbit digital store suitable for television signals sampled at frequencies of up to approximately 3 x color sub-carrier frequency. The design had to be flexible in order to meet a wide-range of requirements involving this type of storage. The final machine met its target specification and incorporated a comprehensive store control system which greatly assists the user in the management of this large store. The store was constructed in two identical halves which could be used for two independent investigations, provided that each required no more than the capacity corresponding to one television field. The completed store could also be used for other applications involving much lower sampling frequencies, such as those used for digital audio signals. Author

N77-21271 British Broadcasting Corp., Kingswood (England). Engineering Div.
UHF SCATTER PROPAGATION ACROSS THE ENGLISH CHANNEL
G. H. Millard Mar. 1977 16 p refs
(BBC-RD-1977/10) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The incidence of scatter propagation in a trans-horizon path across the English Channel has been studied in order to assess the effect it has on the performance of a UHF television re-broadcast link to the Channel Islands. For small angles of scatter the degree of scattering observed was consistent with simple theory. The effect will result in a relatively minor degradation of link performance. Author

N77-21272*# ECON, Inc., Princeton, N.J.
ESTIMATION OF THE DEMAND FOR PUBLIC SERVICES COMMUNICATIONS Final Report
7 Dec. 1976 208 p
(Contract NASw-2558)
(NASA-CR-152654; Rept-76-263-1) Avail: NTIS HC A10/MF A01 CSCL 17B

Market analyses and economic studies are presented to support NASA planning for a communications satellite system to provide public services in health, education, mobile communications, data transfer, and teleconferencing. Author

N77-21273*# Alabama A & M Univ., Huntsville. School of Technology.
PSEUDO NOISE TEST SET OPERATION MANUAL
Glenn Weathers 31 Jan. 1977 32 p
(Contract NAS9-14770)
(NASA-CR-151248) Avail: NTIS HC A03/MF A01 CSCL 17B

Pseudonoise (PN) test set was designed to provide a reliable, operationally simple unit which allows the previously mentioned analog rms end-to-end error measurement of most communication systems to be easily performed. It also provides a band-limited pseudorandom noise as input, thereby escaping the disadvantages of most deterministic signals while retaining the advantages of using true-band-limited noise. In addition, the PN test set has the capability to be used as a means with which the autocorrelation function and impulse response may be determined for certain systems. Author

N77-21274*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYSIS OF TRANSMISSION ERROR EFFECTS ON THE TRANSFER OF REAL-TIME SIMULATION DATA
Leonard Credeur Apr. 1977 27 p refs
(NASA-TM-X-74019) Avail: NTIS HC A03/MF A01 CSCL 17B

An analysis was made to determine the effect of transmission

errors on the quality of data transferred from the Terminal Area Air Traffic Model to a remote site. Data formating schemes feasible within the operational constraints of the data link were proposed and their susceptibility to both random bit error and to noise burst were investigated. It was shown that satisfactory reliability is achieved by a scheme formating the simulation output into three data blocks which has the priority data triply redundant in the first block in addition to having a retransmission priority on that first block when it is received in error. Author

N77-21275*# General Electric Co., Schenectady, N.Y.
ATS-3 RANGING SUPPORT
Axel F. Brisken 6 Jan. 1977 25 p refs
(Contract NAS5-20994)
(NASA-CR-152470; SRD-77-037) Avail: NTIS HC A02/MF A01 CSCL 17B

The purpose of this effort was to provide NASA-Goddard Space Flight Center with ATS-3 ranging data from ground stations of the VHF network and from an additional ground station installed at the NASA-Goddard Space Flight Center. Ranging measurements to the NASA transponder enabled calculation of the transponder's line-of-position. Installation of an S-band transponder at the same site and the conduct of ranging experiments to this transponder and others via ATS-6 provided a second line-of-position. The NASA S-band transponder was specifically designed for installation aboard spacecraft. Consequently, this program provided NASA an opportunity to compare two different techniques using geostationary satellites in the tracking low orbit satellites. Author

N77-21276*# General Electric Co., Schenectady, N.Y.
L-BAND TONE-CODE-DATA TRANSPONDER CALIBRATION
Axel F. Brisken 6 Jan. 1977 50 p refs
(Contract NAS5-20944)
(NASA-CR-152471; SRD-77-038) Avail: NTIS HC A03/MF A01 CSCL 17B

The objectives of this program were to identify and quantify factors which affect the performance of the L-band tone-code-data ranging transponders. Specific objectives included the following: (1) assemble the L-band ranging transponder, previously deployed in Hawaii for the tracking of the ATS-5 satellite, at the GE Radio-Optical Observatory; (2) configure the observatory to conduct calibration exercises with the transponder; and (3) conduct sufficient calibration experiments to demonstrate factors which degrade transponder accuracy, precision, and reliability, to quantify these factors where possible, and to verify long term transponder stability under controlled conditions. Author

N77-21277*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
A DEPOLARIZATION AND ATTENUATION EXPERIMENT USING THE CTS SATELLITE. VOLUME 2: DATA Final Report, 1 Oct. 1975 - 30 Sep. 1976
C. Bostian, S. B. Bolt, Jr., S. R. Kauffman, E. A. Manus, R. E. Marshall, W. L. Stutzman, and P. H. Wiley 23 Feb. 1977 102 p refs
(Contract NAS5-22577)
(NASA-CR-152482) Avail: NTIS HC A06/MF A01 CSCL 17B

An experiment for measuring precipitation attenuation and depolarization on the CTS 11.7 GHz downlink is described. Author

N77-21278*# Comsat Labs., Clarksburg, Md.
A FIVE-FREQUENCY RADIOMETER ANTENNA SYSTEM FEED HORN Final Report
Jan. 1976 40 p refs
(Contract NAS5-20637)
(NASA-CR-152486) Avail: NTIS HC A03/MF A01 CSCL 17B

The feasibility of operating a five frequency feed as a radiometer for use on board a Nimbus type satellite was investigated. Five narrow band frequencies (6.6, 10.7, 18.5, 21.5 and 33 GHz) were multiplexed onto a single receive feed employing dual linear polarization at each frequency with a better than 25 db isolation between each polarization. The production of a horn design which can illuminate a parabolic reflector segment with an f/D ratio of approximately 0.4, producing an edge illumination of approximately -20 db is described. The final overall design is presented with results showing that this design concept has an acceptable electrical performance. Author

N77-21279# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
AN INNOVATIVE METHOD FOR MEASURING FREQUENCY STABILITY WITHOUT DEADTIME
E. M. Hicks 1976 18 p refs Presented at 6th Ann. Meas. Sci. Conf. at Cal-Poly, San Luis Obispo, Calif., 3-5 Dec. 1976 (X76-1297/120) Avail: NTIS HC A02/MF A01

Frequency stability and its measurement are elaborated, and a simple innovative test system or method which eliminates an undesirable factor known as deadtime is described. The method described (a single mixer time-mark system) eliminates deadtime in measuring the output of a single mixer system. It is useful over a wide range of averaging times and can be implemented in several ways including a simple and inexpensive modification to certain existing commercial electronic counters. The single mixer time-mark system has successfully been demonstrated in a production test program for precision frequency standards. A table summarizes some of the advantages and disadvantages of beat frequency methods discussed. Author

N77-21280*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AIRCRAFT MEASUREMENT OF RADIO FREQUENCY NOISE AT 121.5 MHz, 243 MHz AND 406 MHz
Ralph E. Taylor and James S. Hill (RCA Service Co., Springfield, Va.) Jan. 1977 8 p refs Proposed for presentation at 2d Symp. and Technical Exhibition on Electromagnetic Compatibility, Montreux, Switzerland, 28-30 Jun. 1977
(NASA-TM-X-71283; X-952-77-11) Avail: NTIS HC A02/MF A01 CSCL 17B

An airborne survey measurement of terrestrial radio-frequency noise over U.S. metropolitan areas was carried out at 121.5, 243 and 406 MHz with horizontal-polarization monopole antennas. Flights were at 25,000 feet altitude. Radio-noise measurements, expressed in equivalent antenna-noise temperature, indicate a steady-background noise temperature of 572,000 K, at 121.5 MHz, during daylight over New York City. This data is helpful in compiling radio-noise temperature maps; in turn useful for designing satellite-aided, emergency-distress search and rescue communication systems. Author

N77-21281*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SIMPLE TECHNIQUE FOR HIGH RESOLUTION TIME DOMAIN PHASE NOISE MEASUREMENT
Victor S. Reinhardt and Theresa Donahoe Mar. 1977 14 p refs Presented at the NASA/DOD PTTI Planning Meeting Submitted for publication
(NASA-TM-X-71300; X-814-77-43) Avail: NTIS HC A02/MF A01 CSCL 20N

A new time domain phase comparator is described. The device uses a novel technique to allow time domain phase measurements to be made with period and time interval counters without the use of offset reference oscillators. The device uses a single reference oscillator and allows measurements with a phase resolution greater than the noise floor of the reference. Data is presented showing a phase resolution of 0.02ps at 5 MHz with a crystal reference. The device has application in measuring the phase stability of systems where approximate phase quadrature can be maintained. Author

N77-21282*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMMUNICATIONS TECHNOLOGY SATELLITE OUTPUT-TUBE DESIGN AND DEVELOPMENT
Denis J. Connolly, Ralph Forman, C. L. Jones (Litton Industries, San Carlos, Calif.), Henry G. Kosmahl, and G. Richard Sharp Washington Apr. 1977 21 p refs
(NASA-TM-X-3480; E-8776) Avail: NTIS HC A02/MF A01 CSCL 17B

The design and development of a 200-watt-output, traveling-wave tube (TWT) for the Communications Technology Satellite (CTS) is discussed, with emphasis on the design evolution during

the manufacturing phase of the development program. Possible further improvements to the tube design are identified. Author

N77-21283# Sandia Labs., Albuquerque, N.Mex.
ELASTIC WAVE PROPAGATION THROUGH AN INFINITE STRATUM OF POROUS MATERIAL
J. R. Janczy, Jr. Sep. 1976 12 p refs
(Contract AT(29-1)-789)
(SAND-76-0328) Avail: NTIS HC A02/MF A01

A model for the prediction of porosity in an infinite stratum of porous material was developed. The stratum is bounded on the upper and lower surfaces by nonporous media of infinite thickness. Consideration of transverse stress waves through this system leads to an expression for the porosity of the internal stratum. ERA

N77-21284# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
DEPOLARIZATION BY RAIN. SOME RELATED THERMAL EMISSION CONSIDERATIONS
A. Mawira and J. Dijk Sep. 1975 94 p refs
(TH-75-E-61; ISBN-90-6144-0610) Avail: NTIS HC A05/MF A01

The electromagnetic properties of a medium containing axisymmetric raindrops were investigated. The propagation of a monochromatic plane wave through this medium was considered and a corresponding differential equation derived. The aspect of thermal emission closely connected to the problem is dealt with. The Stokes spectral vector representation of the thermal emission field is presented. The differential equations derived, as well as some thermodynamic considerations, were used to derive a transfer equation for this Stokes spectral vector. The solution of this equation yields expressions for the generalized anisotropic effective temperature vector. The relation between various quantities referring to monochromatic signals, such as the cross polarization parameters and the thermal emission magnitudes, are discussed. Author (ESA)

N77-21285# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
CALCULATION OF RADIATION PATTERNS OF REFLECTOR ANTENNAS BY HIGH-FREQUENCY ASYMPTOTIC TECHNIQUES
M. Safak Mar. 1976 77 p refs
(TH-76-E-62; ISBN-90-6144-062-9) Avail: NTIS HC A04/MF A01

The radiation pattern of a focus-fed paraboloid was calculated by asymptotic physical optics (APO) and the geometrical theory of diffraction (GTD) for dipole and Huygens source feeds. It is shown that the GTD diffraction coefficients are approximations to the PO diffraction coefficients and are valid only in the proximity of the shadow and reflection boundaries. Some errors in the calculation of GTD diffraction coefficients were corrected. Rear radiation was calculated by another asymptotic expansion of the physical optics integral and was compared with the results obtained by other asymptotic techniques. This new expansion is finite in the back of the antenna where other methods diverge. Also, front to back ratio of a paraboloid, ratio of front radiation to back radiation, was derived by using this new expansion, and the results compared with those predicted by equivalent edge currents method. Author (ESA)

N77-21286# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
SOFT DECISION SYNDROME DECODING
J. P. M. Schalkwijk and A. J. Vinck Mar. 1976 16 p refs
(TH-76-E-63; ISBN-90-6144-063-7) Avail: NTIS HC A02/MF A01

The method described for soft decision Viterbi-like syndrome decoding is not only valid for R = 1/2 but for all R = k/n Viterbi-like syndrome decoders. The number of different state matrices in the R = 1/2 case cannot be reduced. It seems that the advantages of syndrome decoding for long constraint length codes disappear. ESA

N77-21287# Electronics Engineering Group (1842nd), Richards-Gebaur AFB, Mo.
AUTOMATED DATA ACQUISITION APPLIED TO MONITORING OF COMMUNICATIONS SYSTEMS Final Report
David A. Lindberg 1 Oct. 1976 84 p refs
(AD-A031474; Rept-1842-EEG/EPEUT-TR-77-4) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report describes a design concept for an automated distributed data acquisition system. Particular emphasis is placed on uses of automated state-of-the-art data acquisition techniques for monitoring of communication systems. Use of distributed processing, industry standard interfaces, and a real-time software operating system is discussed. GRA

N77-21288# Institute for Telecommunication Sciences, Boulder, Colo.
CONSIDERATIONS IN THE USE OF OPTICAL WAVEGUIDES IN SUBMARINE CABLE SYSTEMS
R. L. Gallawa Sep. 1976 54 p refs
(PB-260722/4; OTR-76-103) Avail: NTIS HC A04/MF A01 CSCL 17B

The cost of providing power to remote repeaters for a submarine cable system is investigated. Consideration is given to the self-contained radioisotope thermoelectric generator (RTG) unit and a copper cable feed from a shore power station. The copper can presumably be made an integral part of the glass fiber cable. It was found that copper feed is more economical than the RTG unit and the regions and definitions of more economical power feed are discussed and displayed in graphical form. An example compares the expected cost of an optical waveguide system with a system using SD submarine coaxial cable. GRA

N77-21289# Rockwell International Corp., Cedar Rapids, Iowa. Collins Radio Group.
TRANSCEIVER MULTICOUPLERS Final Report, 15 Feb. - 15 Jul. 1976
Harvey L. Landt Sep. 1976 74 p refs
(Contract DAAB07-75-C-0113)
(AD-A031394; ECOM-75-0113-F) Avail: NTIS HC A04/MF A01 CSCL 09/5

This final report covers the development, construction, and test of the advanced development models of the transceiver multicoupler. Deliverable hardware consists of a 2-channel multicoupler, 5-channel multicoupler, and a spare filter. The theoretical basis and experimental principles of the design are discussed in section 2. A description of the deliverable hardware, test results, and physical configuration are given in section 3. Section 4 discusses an alternate design approach employing a 2-pole bandpass filter in place of the present 3-pole design. Author (GRA)

N77-21290# Air Force Weapons Lab., Kirtland AFB, N.Mex.
THE PERFORMANCE OF THE TATS WIDEBAND MODEM IN SEVERELY SCINTILLATED ENVIRONMENTS Final Report
Leon A. Wittwer and Erle Pettus Sep. 1976 47 p refs
(AD-A032050; AFWL-TR-76-128) Avail: NTIS HC A03/MF A01 CSCL 20/14

The performance of the Tactical Transmission System (TATS) wideband modem is examined in scintillated environments. The analysis included both acquisition of signal and decoding behavior. The effects of time and frequency tracking errors were also included. Author (GRA)

N77-21291# Raytheon Co., Sudbury, Mass.
HYBRID TROPO TRANSMISSION SYSTEM Final Technical Report, 15 May 1973 - 29 Dec. 1975
Manfred Unkauf and Robert Dagnell Aug. 1976 233 p
(Contract F30602-73-C-0273)
(AD-A032000; RADC-TR-76-250) Avail: NTIS HC A11/MF A01 CSCL 17/2

This document describes the design, development, laboratory testing, and over-the-air testing of a Digital Data Tropo Transmission System and Hybrid Tropo Transmission System (HTTS). Digital transmission was accomplished at data rates of 1.75, 3.5 and 7.0 Mbps by using the Raytheon Distortion Adaptive Receiver (DAR-IV) modulation/demodulation (modem) technique. Testing of the DAR-IV was performed using the RADC troposcatter media simulator and comfirmed by actual over-the-air tests on the AN/MRC-98, AN/TRC-97 and AN/TRC-132 radio

equipments in both modes. The test results showed that the DAR-IV technique has the potential to provide quality digital data transmission on both tactical and DCS troposcatter links. Within its multipath spread capabilities, the DAR-IV was shown to typically operate within 3 dB of theoretical. The extent of multipath spread accommodated was found to be approximately equal to the inverse of the transmission bit rate. Design improvements are identified to achieve greater multipath spread capacity at the higher data rates. Hybrid transmission was accomplished by using separate analog and digital subcarriers with conventional FDM/FM modulation for analog traffic of up to 60 voice channels. Testing in the hybrid transmission mode revealed that a dual subcarrier approach was feasible but somewhat inefficient in power utilization. Author (GRA)

N77-21292# Naval Electronics Lab. Center, San Diego, Calif.
AN/GRA-39 RADIO SET CONTROL GROUP MODIFICATION. ADDITION OF TWO CAPACITORS AND A CHOKE TO MICROPHONE INPUT CIRCUITS ENABLES AN/GRA-39 TO BE USED WITH NEW MC HF RADIO SYSTEMS Final Report, 30 Jun. 1975 - 11 Mar. 1976
R. J. Hessling 12 Aug. 1976 32 p
(NELC Proj. T270)
(AD-A031763; NELC-TR-2002) Avail: NTIS HC A03/MF A01 CSCL 17/2

Laboratory tests verify the reported susceptibility of the AN/GRA-39 to powerful hf fields. Instability results from detection of the envelope of an AM signal by the remote unit microphone amplifier input circuit. The modification reduces the rf vulnerability of the remote unit by 40-60 dB over the 2-30 MHz band. The modified AN/GRA-39 is shown to be operationally compatible with the TSEC/KY-65 narrowband secure voice unit. GRA

N77-21293# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
STUDIES OF SPEECH ANALYSIS AND SYNTHESIS Final Report, 1 Jul. 1972 - 31 Mar. 1975
K. N. Stevens, D. H. Klatt, W. L. Henke, and V. W. Zue 6 Oct. 1976 13 p refs
(Contract N00014-67-A-0204-0069; NR Proj. 049-341)
(AD-A031656) Avail: NTIS HC A02/MF A01 CSCL 17/2

Much of the research that has been carried out under this contract has been concerned with the specification of attributes of the speech signal that characterize the speech of particular individuals as opposed to attributes that describe the linguistic content of the speech. A related project has been to devise procedures for synthesis of different voices in order to gain further insight into the attributes that distinguish one speaker from another. An objective of some of the more recent work on the contract has been to determine and to interpret the acoustic characteristics of particular consonant and vowel sounds in various phonetic environments, with application both to the speaker-identification problem and to the speech recognition problem. The report includes a listing of reports and papers issued under the contract. GRA

N77-21294# Illinois Univ., Urbana-Champaign.
MODELS AND EFFICIENT RECEIVERS FOR COMMUNICATION CHANNELS WITH MEMORY Ph.D. Thesis
Pramod Kumar Varshney Sep. 1976 142 p refs
(Contract DAAB07-72-C-0259; Grant DAAG29-76-G-0154)
(AD-A031559; R-744; UILU-ENG-76-2232) Avail: NTIS HC A07/MF A01 CSCL 17/2

In the present work, some aspects of digital communications over channels with memory are studied. The basic objective is to model channels with memory and to develop more efficient and reliable communication techniques over such channels. In particular, the receiver design problem for channels with memory is considered and then the relationship of receivers and channel models is examined. In the receiver design problem, fading is assumed to be the source of channel memory. First, the idea of receivers with memory is investigated and a suboptimal receiver with one-bit memory is derived which performs better than the optimal receiver without memory. A receiver with large memory is devised which consists of an estimator and a detector. The decision rule adapts to the channel conditions based on the information provided by the estimator. The performance of the receiver is examined by computing the average probability of error. The estimator is a limited-memory decision-feedback estimator, the estimation criterion being the MMSE. Finally, a methodology is described which can be used to develop channel models based on the physical processes involved. Two measures are defined which quantitatively characterize the correlation of errors and then the relationship of the receiver design problem to channel modeling is examined. Author (GRA)

N77-21295# GTE Sylvania, Inc., Needham Heights, Mass. Electronic Systems Group.
ADAPTIVE MULTILEVEL 16 KB/S SPEECH CODER Final Report, Nov. 1975 - Jun. 1976
A. Goldberg 14 Jun. 1976 165 p refs
(Contract DCA100-76-C-0002)
(AD-A031516) Avail: NTIS HC A08/MF A01 CSCL 17/2

This report describes software designed by GTE Sylvania for a high quality 16,000 bit per sec. speech terminal. This software operates in a full duplex mode on two Sylvania Programmable Signal Processors. Author (GRA)

N77-21296# Codex Corp., Newton, Mass.
CODEX SPEECH DIGITIZER ADVANCED DEVELOPMENT MODEL Final Report, Jun. 1975 - Jun. 1976
G. D. Forney and S. Qureshi Jun. 1976 176 p refs
(Contract DCA100-76-C-0026)
(AD-A031509) Avail: NTIS HC A09/MF A01 CSCL 17/2

This report describes the Codex Speech Digitizer Advanced Development Model. The speech coder operates at rates of 16 and 9.6 kbps using three selectable techniques: Adaptive Residual Coding (ARC), Continuously Variable Slope Delta (CVSD) modulation, and Adaptive Delta Modulation (ADM).
Author (GRA)

N77-21297# Electronic Communications, Inc., St. Petersburg, Fla. Research and Advanced Development Lab.
ADAPTIVE ERROR CORRECTING TECHNIQUES FOR USE IN AIRBORNE SATELLITE COMMUNICATIONS SYSTEMS Final Report
Richard K. Smith Sep. 1976 79 p refs
(Contract F33615-75-C-1231)
(AD-A031983; AFAL-TR-76-103) Avail: NTIS HC A05/MF A01 CSCL 17/2

Airborne satellite communication systems have been shown to frequently suffer severe degradation of performance due to ionospheric scintillation. This type of interference produces deep fades in received signal power resulting in long error bursts in the demodulated data stream. The objective of this study was to lay the groundwork for a quantitative evaluation of the performance improvement that can be achieved through the use of an adaptive error control technique. Specifically, the adaptive Gallager algorithm and the extended Gallager algorithm were examined to determine which of these provides the better solution to the error control problem on this channel. The first phase of this study dealt with the heuristic analysis of these two error control techniques on the basis of binary error sequences generated from flight test records of received signal level. Phase I culminates with a recommendation as to which technique should be used. Suggestions regarding the values of important algorithm parameters are also provided. Phase II of this study was devoted to the development of a computer simulation algorithm and the design of a hardware evaluator for the recommended coding technique. The algorithm, used with the AFAL channel simulator, permits the quantitative evaluation of code performance on the simulated scintillation channel. GRA

N77-21298# Edgerton, Germeshausen and Grier, Inc., Albuquerque, N.Mex.
FIVE-CHANNEL MICROWAVE SYSTEM Final Report, Jun. 1975 - Feb. 1976
D. L. Trone and G. D. Sower Kirtland AFB, N. Mex. AFWL Aug. 1976 71 p refs
(Contract F29601-75-C-0131)
(AD-A032007; AFWL-TR-76-71) Avail: NTIS HC A04/MF A01 CSCL 17/2

This document describes the development and production of 5-channel microwave data transmission systems. These systems are to provide a 300 foot data link to transmit measurement data from a test object such as a missile or aircraft placed in

an EMP test facility to a shielded instrumentation room or trailer where the data can be recorded. The systems can be used in any test facility that requires up to 300 feet isolation between the test object and the instrumentation recording system. These systems were designed and fabricated under Air Force Contract No. F29601-75-C-0131. Author (GRA)

N77-21299# E-Systems, Inc., Dallas, Tex.
STORED FORMAT AUTOMATED COMMUNICATION TERMINAL (STORFACT) Final Technical Report, 25 Apr. 1975 - 12 May 1976
J. G. Carr and A. R. Etheredge Griffiss AFB, N. Y. RADC Aug. 1976 34 p
(Contract F30602-75-C-0216)
(AD-A031976; RADC-TR-76-263; Rept-416-04158) Avail: NTIS HC A03/MF A01 CSCL 17/2

STORFACT is an alternate input/output device for the AN/UYA-7 (V) Communications Terminal. STORFACT utilizes a solid state, Plasma Discharge Display module capable of displaying up to 256 characters. Associated with the display is a memory capable of holding four 256 character pages (1,024 characters). The STORFACT System provides up to nine selectable, predetermined formats, including one for free text. This is accomplished by means of removable, reprogrammable Read Only Memories (ROM's). A tenth format is provided by a Random Access Memory (RAM). Formats are protected such that keyboard entry of data into a non-variable position is impossible. Formats, including variable data, are limited to 512 characters. Comments may be added to the end of a format message to make a total of 1,024 characters. All 1,024 characters are not necessarily transmitted. Editing may be accomplished by write-over of any character of variable data. Received messages are stored in a separate 1,024 character memory so that receipt of a message will not interfere with message composition. Author (GRA)

N77-21300# Army Electronics Command, Fort Monmouth, N.J.
REDESIGN OF SQUELCH MODULES IN THE AN/VRC-12 SERIES RADIOS
Lee VanderBooke Oct. 1976 32 p
(AD-A032088; ECOM-4448) Avail: NTIS HC A03/MF A01 CSCL 17/2

The squelch modules (A5200 and A5300) of the AN/VRC-12 series radios were redesigned. Difficult to obtain germanium and early generation silicon transitors were replaced by an integrated circuit and modern silicon transistors. Modifications were made for response deficiencies in the old design. The new design is cost effective over the old. Author (GRA)

N77-21301# Army Electronics Command, Fort Monmouth, N.J.
TECHNIQUES FOR ADAPTIVE CONTROL OF DIFFRACTION MODE AND TROPOSCATTER ANTENNAS Interim Report
George E. Krause and Paul C. Ng Sep. 1976 19 p refs
(AD-A031579; ECOM-4432) Avail: NTIS HC A02/MF A01 CSCL 17/2

Beyond the horizon, radio communications via troposcatter or diffraction modes are frequently troubled by bending of the RF rays due to changes in the atmospheric index of refraction. This can cause the received angle of arrival to appear outside the antenna's main lobe. A possible solution is to adapt the antenna's response to these changes. This report discusses possible state-of-the-art techniques, tradeoffs, potential problems and cost aspects for developing an adaptive antenna control system for use on existing troposcatter/diffraction mode antenna dishes. Author (GRA)

N77-21302# Aeronutronic Ford Corp., Willow Grove, Pa. Radio Transmission Equipment Engineering Lab.
MICROWAVE DATA TRANSMISSION TEST PROGRAM DIGITAL APPLIQUE UNIT Final Technical Report, Apr. - Dec. 1975
F. A. Jessen, Norman G. Jones, J. W. Layer, R. J. Konzelman, Benjamin Olevsky, and J. Vetack Griffiss AFB, N. Y. RADC Aug. 1976 247 p refs
(Contract F30602-73-C-0203)
(AD-A032014; RADC-TR-76-268) Avail: NTIS HC A11/MF A01 CSCL 17/2

The object of the Microwave Data Transmission Test Program - Digital Applique Unit (DAU) was to design, construct and system test a Digital Applique Unit. The DAU is a time division multiplex/modem equipment which permits conventional FDM/FM microwave radio equipments to be converted to all digital transmission. The DAU is designed to accept and deliver one or two mission bit streams (MBS) with rates up to 12.672 Mbps and a single service channel bit stream (SCBS) of 192 Kbps, and provide an error rate of 10 to the minus 7th power for a carrier to noise ratio of 24 db or less with a packing density of 2 bits/Hz. A uniquely designed receiver switch module of the DAU permits the attainment of relatively high diversity gain without the introduction of switch-induced error or loss of bit count integrity. Provisions for both on-line and off-line BER measurements are provided as part of the built in performance assessment capability. Author (GRA)

N77-21303# Electronic Communications, Inc., St. Petersburg, Fla.
CHANNEL SELECT MEMORY Final Technical Report, Sep. 1974 - Jul. 1975
Wayne Peck Wright-Patterson AFB, Ohio AFAL Jul. 1976 27 p
(Contract F33615-75-C-1108)
(AD-A031387; AFAL-TR-75-213) Avail: NTIS HC A03/MF A01 CSCL 17/2

A fully decoded 512-bit (32 x 16) MNOS electrically word alterable, semiconductor memory was developed for use in channel preselect applications to control the frequency in UHF communication systems. It includes address and timing buffers, row decoders, column detectors, and input/output circuitry. Packaged in a standard 28-pin dual inline ceramic package, the memory characteristics are: (1) electrically erasable by word, (2) 100 milliseconds erase and write time, (3) 8 microseconds read time, (4) 2 times 10 to the 11th power read accesses/word between refreshes, (5) unpowered nonvolatile data storage one-year minimum, (6) common data inputs/outputs compatible with 400 series CMOS and 5400 TTL, (7) data outputs high impedance when memory deselected, (8) operating temperature -55 C to -125 C, (9) power supply requirements of 5 volts + or - 5 volt DC and 28 volts + or - 1.5 volts DC at 10 milliamps maximum currents. A small quantity of memories selected from three production lots to demonstrate reproducibility were delivered to AFAL. Prior to shipment, a design and device parameter test program was conducted to verify conformance to the above parameters. Author (GRA)

N77-21304# Rome Air Development Center, Griffiss AFB, N.Y.
EFFECT OF MULTIPATH ON THE HEIGHT-FINDING CAPABILITY OF FIXED-REFLECTOR RADAR SYSTEMS. PART 2: APPLICATION TO AN AIR SEARCH RADAR SYSTEM
Ronald L. Fante, Peter R. Franchi, and Richard L. Taylor Jul. 1976 30 p
(AD-A031590; RADC-TR-76-215-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 17/9

The errors due to multipath in target altitude for a modified air search radar system have been evaluated. A method for decreasing these altitude errors has been discussed and evaluated. GRA

N77-21305# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
EFFECT OF INSTRUMENT SITING AND COORDINATE SELECTION ON GDOP IN TARGET TRACKING
B. D. Sivazlian and R. E. Green (US Army White Sands Missile Range) 1976 8 p refs Proc. of the Natl. Aerospace Electron. Conf.
(Grant DAHC04-75-G-0150)
(AD-A031831; ARO-12640.9-M) Avail: NTIS HC A02/MF A01 CSCL 16/4

Simultaneous direct measurements taken in elevation, azimuth, and range for independent instrumentation sources, when aggregated and reduced can often yield sensible estimates. However, strong aberrations and inconsistencies in the estimates derived from data reduction have been known to occur. Two particular factors are investigated in order to partially explain theoretically these elusive deviations and to establish some cause

and effect relationship. The first set of factors relates to the relative geometric siting of the instruments as well as the type of measurements recorded. Typical measurements which would be conducive to such aberrations are discussed. The second set of factors relates to the selection of a frame of reference for aximuthal measurement. It is shown that coordinate selection can play, for certain types of measurements, a significant role in multiplying the GDOP by severalfold from a rationally established minimum basis. Author (GRA)

N77-21306# Naval Research Lab., Washington, D. C.
ELF NONLINEAR NOISE PROCESSING EXPERIMENTAL MEASUREMENTS. PART 2: SYNOPTIC SAMPLE OF DIURNAL AND SEASONAL NOISE VARIATION IN NORWAY Interim Report
John R. Davis and William D. Meyers 29 Oct. 1976 35 p refs
(AD-A033402; NRL-8039-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 17/2

Using a suitable nonlinearity in the input stage of an extremely low frequency receiver can improve received signal-to-noise ratio S/N by whitening the nongaussian atmospheric noise at these frequencies. Previous studies indicate that performance of simple clippers, carefully adjusted on the basis of the raw noise amplitude statistics, is very nearly equal to that of the optimum clipper. A collection of ELF noise data for all seasons and nearly all times of day has been acquired at a receiving site in the auroral zone near Tromso, Norway. These data have been used to evaluate the improvement in S/N that can be expected from simple clipping under a variety of noise and propagation conditions. A regular diurnal variation in effective (processed) noise level is observed under quiet conditions. Under both quiet and noisy conditions, little performance difference is observed among processing channels with clipping levels as far apart as 6 to 18 dB, in the vicinity of the optimum clipping level. The nonlinear processing method described in this report provides at least 10 dB of S/N improvement over the performance obtained without suitable processing. GRA

N77-21307# Raven Industries, Inc., Sioux Falls, S.Dak. Electronic Systems Div.
FUNCTIONAL TESTING OF BALLOON COMMAND RECEIVER. SKYHOOK 1975
Homer Lee and Tom Pappas 27 Aug. 1976 36 p
(Contract N00014-75-C-1063)
(AD-A033600; R-0876005) Avail: NTIS HC A03/MF A01 CSCL 17/2

Raven Industries was given the task of flight testing ten command receivers. These tests were to consist of bench tests, simulated flight tests in the Raven altitude chamber, and three flight tests under actual conditions. Ten command receivers were supplied by Dr. Williamson for these tests. In addition, Dr. Williamson supplied a ground station for sending the termination commands. Additionally, a prototype digital ranging generator and readout were provided for the last flight of the series. One unit was flown as a hitch-hike on the University of Wyoming flight No. 1389. This unit operated properly during the short daytime flight. The flight was terminated early due to failure of the prime experiment. Three units were flown on Flight 1390. This was primarily a night time flight to determine cold effects on the command receivers. One unit failed to complete a command cycle due to temperature effects on the decoder circuit. The other units operated properly throughout the flight. Another was flown on Flight 1389 and two additional receivers were flown on Flight 1391. The latter units provided flight data in direct sunlight. Flight 1391 was used to demonstrate the digital range read-out system developed by Dr. Williamson. The receivers and ranging system performed perfectly throughout the flight. The audio retransmission was monitored periodically throughout all of the flights with no intermodulation being noted. The original data transcribed in this report is on file at Raven Industries, Inc. GRA

N77-21308# Computer Sciences Corp., Falls Church, Va.
AEROSAT ACCESS CONTROL SUMMARY Final Report, Jul. 1975 - May 1976
H. A. Blank, G. V. Kinal, and L. Klein (DOT) Oct. 1976 90 p refs
(Contract DOT-TSC-1079)
(PB-261325/5; DOT-TSC-FAA-76-18; DOT-TSC-OST-76-20; ; FAA-RD-76-112) Avail: NTIS HC A05/MF A01 CSCL 17G

The communication concepts germane to AEROSAT access control are discussed. The principles of multiplexing, multiple access, demand access, and access control are included. The evaluation approach taken, the access control techniques considered, and the conclusions reached by three AEROSAT access control studies are summarized. Recommendations are presented for AEROSAT access control techniques, based upon the results of the three studies and the access control techniques defined in appropriate AEROSAT documentation. GRA

N77-21309# ITT Gilfillan, Inc., Van Nuys, Calif.
MM AND TE-APPLICATION OF RADAR TO BALLISTIC ACCEPTANCE TESTING OF AMMUNITION (ARBAT). PHASE B: ANTENNA DEVELOPMENT/FABRICATION Final Report
C. Barfield 30 Sep. 1976 118 p
(Contract DAAA21-73-C-0664)
(AD-A033605; ITTG-5059B) Avail: NTIS HC A06/MF A01 CSCL 17/9

Antenna design analyses performed in an earlier program phase (ARBAT System Design Study) were validated and used in the final development and fabrication of an 'X' band phase/frequency mechanical scanning radar antenna to be incorporated in a radar system for ballistic ammunition acceptance testing. The antenna is a 10 by 12 ft aperture planar array. Elevation scanning is accomplished by phase changes produced by digitally controlled 4 bit diode phase shifters. Scanning in azimuth is by frequency variation and mechanical rotation of the array. Development steps included fabrication and testing of individual critical items and assemblies of critical items to estimate fully array performance. A 9 element partial array was range tested prior to fabrication of the required 167 horizontal array elements and associated microwave elements. The mechanical and electrical design is discussed and test results are summarized. GRA

N77-21310# Harry Diamond Labs., Adelphi, Md.
SINGLE-SIDEBAND MODULATOR FOR DOPPLER SIMULATION
Robert V. Garver Sep. 1976 63 p refs
(DA Proj. 1T0-61102-B-14A)
(AD-A032994; HDL-TR-1763) Avail: NTIS HC A05/MF A01 CSCL 17/9

The modulation requirements of a Doppler simulator are analyzed in detail. A modulator using two PIN diodes Lamda/8 apart is described and analyzed. It satisfies the requirements over a broad bandwidth; the conversion loss is independent of the incident power level; and the circuit is inexpensive, simple and noncritical. The performance of the modulator is compared with that of a mixer and with that of a conventional type of single-sideband modulator. Author (GRA)

N77-21311# Army Electronics Command, Fort Monmouth, N.J.
A 60 GHz DIGITAL FM SIMPLEX SYSTEM Final Report, Jul. 1975 - Aug. 1976
Emanuel Fliegler Sep. 1976 22 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A033115; ECOM-4434) Avail: NTIS HC A02/MF A01 CSCL 17/2

A 60 GHZ digital FM simplex radio utilizing waveguide is described. This system is operational and will be used as a reference to be compared with future integrated circuit and hybrid millimeter radios. A Gunn Local oscillator was developed which effects significant receiver noise reduction. Subsystem measurements show good characteristics for 1 km propagation. Author (GRA)

N77-21312# Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, Ariz.
DEB STAGE 1 CONUS LINK TESTING Interim Report, May - Sep. 1976
John J. McDonnell, Edward New, and Stephen T. Schoch 29 Oct. 1976 45 p
(AD-A032721; CCC-CED-76-DTEP-014) Avail: NTIS HC A03/MF A01 CSCL 17/2

CONUS link testing was initiated to establish a data base and performance assessment of a similar microwave system in advance of the final implementation of the DEB Stage-1 program. Six AN/FRC 162 radios, two AN/FRC 165 radios, and ten T1-4000 multiplexers were used to establish four terminals with the capability of propagating over eight paths, one of which had a length of 82 miles. Mathematically predicted fade margins were not realized. A large difference was noted in the number of fades recorded at each terminal receiver, over one path. A noteworthy number of fade rates in excess of 70 dB/second was observed, and over 0.5% of recorded fade depths were 30 dB or greater. Except for four dropouts, the long term BER for the 82-mile link was 1*4 x 10 to the minus 12th power. The BER was 1.85 x 10 to the minus 8th power after eight transmission links of baseband repeaters, but with a 10 dB fade margin. Variability among multiplexer sensitivities was important in determining the distribution of errors in the baseband repeater tests. Author (GRA)

N77-21113*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK-MARINER JUPITER/SATURN 1977 FLIGHT PROJECT TELECOMMUNICATIONS COMPATIBILITY Summary and Status Report
A. I. Bryan, R. P. Kemp, and B. D. Madsen *In its* The Deep Space Network 15 Apr. 1977 p 16-37 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N77-21121*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF A DISCRETE SPECTRUM ANALYZER FOR THE DETECTION OF RADIO FREQUENCY INTERFERENCE
B. K. Levitt *In its* The Deep Space Network 15 Apr. 1977 p 83-98 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

N77-21123*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SYNCHRONIZATION STRATEGIES FOR RFI CHANNELS
R. J. McEliece, H. VanTilborg (Calif. Inst. Tech., Pasadena, Calif.), and S. Tung (Cornell Univ., Ithaca, N.Y.) *In its* The Deep Space Network 15 Apr. 1977 p 103-108 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

N77-21131*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROPORTIONALITY BETWEEN DOPPLER NOISE AND INTEGRATED SIGNAL PATH ELECTRON DENSITY VALIDATED BY DIFFERENCED S-X RANGE
A. L. Berman *In its* The Deep Space Network 15 Apr. 1977 p 172-183 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N77-21132*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MODIFICATION OF THE DSN RADIO FREQUENCY ANGULAR TROPOSPHERIC REFRACTION MODEL
A. L. Berman *In its* The Deep Space Network 15 Apr. 1977 p 184-186 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N77-21313+ Federal Aviation Agency, Washington, D. C.
GROUNDING, BONDING AND SHIELDING BIBLIOGRAPHY 1930 TO 1971 Final Report
Jan. 1976 127 p
(AD-A034653/6; FAA-RD-76-145) Avail: NTIS HC A07 CSCL 20/3

As a result of a literature search carried out in conjunction with an extensive effort concerning grounding, bonding and shielding, a bibliography was compiled. The bibliography, covering the period 1930 to 1971, is presented. Author

N77-21314* National Aeronautics and Space Administration. Pasadena Office, Calif.
CHARGE STORAGE DIODE MODULATORS AND DEMODULATORS Patent
Milton H. Brockman, inventor (to NASA) (JPL) Issued 1 Jun. 1971 9 p Filed 12 Jul. 1968 Sponsored by NASA
(NASA-Case-NPO-10189-1; NASA-Case-NPO-10781-1; US-Patent-3,582,828; US-Patent-Appl-SN-744522; US-Patent-Class-332-16; US-Patent-Class-307-232; US-Patent-Class-307-238; US-Patent-Class-307-280; US-Patent-Class-329-119; US-Patent-Class-329-205; US-Patent-Class-332-30; US-Patent-Class-332-52) Avail: US Patent Office CSCL 09A

Circuits for the modulation or demodulation of radio frequency signals comprising a charge storage diode which provides a reverse current with a current-time integral equal to that of a forward current which has previously passed through the diode are presented. In the modulator circuit, the carrier signal is coupled to pass through the diode, while the modulating signal biases the diode to govern the phase at which it conducts. The diode output is phase- and amplitude-modulated. In the demodulator circuit, a constant radio frequency signal is coupled to pass through the diode, while the signal to be phase-demodulated biases the diode to govern the phase at which it conducts.
Official Gazette of the U.S. Patent Office

N77-21315* National Aeronautics and Space Administration. Pasadena Office, Calif.
COMPACT, HIGH INTENSITY ARC LAMP WITH INTERNAL MAGNETIC FIELD PRODUCING MEANS Patent
Charles G. Miller, inventor (to NASA) (JPL) Issued 29 Apr. 1975 7 p Filed 2 Aug. 1973 Continuation-in-part of abandoned US Patent-Appl-SN-173178, filed 19 Aug. 1971 Sponsored by NASA
(NASA-Case-NPO-11510-1; US-Patent-3,881,132; US-Patent-Appl-SN-385059; US-Patent-Class-315-344; US-Patent-Class-313-32; US-Patent-Class-313-161; US-Patent-Class-313-184; US-Patent-Class-313-224; US-Patent-Appl-SN-173178) Avail: US Patent Office CSCL 09A

A significant increase in brightness of the arc and a more focusable light-emitting region are provided in compact arc lamps by causing magnetic lines of force to diverge from the cathode tip from magnetic field producing means disposed within the cathode structure. Official Gazette of the U.S. Patent Office

N77-21316* National Aeronautics and Space Administration. Pasadena Office, Calif.
DEPRESSURIZATION OF ARC LAMPS Patent
Charles G. Miller, inventor (to NASA) (JPL) Issued 16 Nov. 1971 8 p Filed 14 Jul. 1969 Sponsored by NASA
(NASA-Case-NPO-10790-1; US-Patent-3,621,330; US-Patent-Appl-SN-841278; US-Patent-Class-315-108; US-Patent-Class-313-175; US-Patent-Class-313-180; US-Patent-Class-313-184; US-Patent-Class-315-110) Avail: US Patent Office CSCL 09A

A closed cycle depressurization system including a lamp envelope for containment of a discharge gas at greater than atmospheric pressure in communication with a gas storage and depressurization chamber is presented. A substantially transparent material, potentially frangible at said pressure forms at least a portion of the envelope. In one embodiment, depressurization is effected by externally cooling the walls of the chamber and in a second embodiment, the chamber contains a gas adsorbent which adsorbs gas to reduce the pressure in the lamp envelope to the desired safe nonoperating level.
Official Gazette of the U.S. Patent Office

N77-21317*# RCA Solid State Div., Somerville, N.J.
ACCELERATED LIFE TESTING EFFECTS ON CMOS MICROCIRCUIT CHARACTERISTICS, PHASE 1 Technical Report, May - Dec. 1976
B. Maximow Dec. 1976 57 p
(Contract NAS8-31905)
(NASA-CR-150228) Avail: NTIS HC A04/MF A01 CSCL 09C

An accelerated life test of sufficient duration to generate a minimum of 50% cumulative failures in lots of CMOS devices was conducted to provide a basis for determining the consistency of activation energy at 250 C. An investigation was made to determine whether any thresholds were exceeded during the high temperature testing, which could trigger failure mechanisms unique to that temperature. The usefulness of the 250 C temperature test as a predictor of long term reliability was evaluated. Author

N77-21318# Rockwell International Corp., Anaheim, Calif. Autonetics Group.

A CCD-SIGNAL CORRECTOR

Stanley A. White 1976 7 p Presented at 10th Ann. Asilomar Conf. on Circuits, Systems, and Computers, Pacific Grove, Calif., 22-24 Nov. 1976

(X76-811/501) Avail: NTIS HC A02/MF A01

The usefulness of charge transfer device (CTD) as an analog shift register is restricted by signal degradation due to charge transfer inefficiency (CTI) within the device. As the charge, which represents an amplitude sample of the signal, is propagated from cell to cell, a portion of the charge remains behind in each transfer operation. This dispersive effect is one which furthermore has been observed to change with operating parameters such as clock frequency and ambient temperature. Our objective is to neutralize the dispersive effect through signal processing techniques. Two advantages accrue: A good CCD may be used in applications where there are very tight performance requirements which would otherwise discourage the use of CCD's and a bad CCD (poor CTI) may be used where otherwise the device would have to be scrapped. Author

N77-21319*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

REMOTE LIGHTNING MONITOR SYSTEM Patent Application

Carl L. Lennon and Thomas O. Britt, inventors (to NASA) Filed 29 Mar. 1977 18 p

(NASA-Case-KSC-11031-1; US-Patent-Appl-SN-782482) Avail: NTIS HC A02/MF A01 CSCL 09C

An apparatus for monitoring, analyzing, and accurately determining the value of peak current, the peak rate of change in current with respect to time, and the rise time of the electrical currents generated in an electrical conductive mast that is located in the vicinity where lightning is monitored is described. The apparatus includes an electrical coil for sensing the change in current flowing through the mast and generating a voltage responsive. An on site recorder and a recorder control system records the voltages produced responsive to lightning strikes and converts the voltage to digital signals for being transmitted back to the remote command station responsive to command signals. The recorder and the recorder control system are carried within an RFI proof environmental housing into which the command signals are fed by means of a fiber optic cable so as to minimize electrical interference. NASA

N77-21320*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

LIGHTNING CURRENT WAVEFORM MEASURING SYSTEM Patent Application

R. J. Wojtasinski, J. C. Fuchs (Federal Electric Corp., Paramus, N. J.), and C. Grove, inventors (to NASA) (Federal Electric Corp., Paramus, N. J.) Filed 30 Mar. 1977 16 p

(NASA-Case-KSC-11018-1; US-Patent-Appl-SN-782693) Avail: NTIS HC A02/MF A01 CSCL 09C

An apparatus for monitoring current waveforms produced by lightning strikes which generate currents in an elongated cable is described. These currents are converted to voltages and to light waves for being transmitted over an optical cable to a remote location. At the remote location, the waves are reconstructed back into electrical waves for being stored into a memory. The information is stored within the memory with a timing signal so that only different signals need to stored in order to reconstruct the wave form. NASA

N77-21321*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

DIGITAL AUTOMATIC GAIN AMPLIFLIER Patent Application

Larry D. Holley and James O. Ward, inventors (to NASA) (Federal Electric Corp., Paramus, N. J.) Filed 24 Mar. 1977 13 p

(NASA-Case-KSC-11008-1; US-Patent-Appl-SN-780729) Avail: NTIS HC A02/MF A01 CSCL 09C

A circuit was made for adjusting the amplitude of a reference signal to a predetermined level to permit subsequent data signals to be interpreted correctly. The circuit includes an operational amplifier having a feedback circuit connected between an output terminal and an input terminal; a bank of relays operably connected to a plurality of resistors; and a comparator comparing an output voltage of the amplifier with a reference voltage and generating a compared signal responsive thereto. Means is provided for selectively energizing the relays according to the compared signal from the comparator until the output signal from the amplifier equals to the reference signal. A second comparator is provided for comparing the output of the amplifier with a second voltage source to illuminate a lamp when the output signal from the amplifier exceeds the second voltage. NASA

N77-21322*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

WIDE POWER RANGE MICROWAVE FEEDBACK CONTROLLER Patent Application

Leo E. Titus, inventor (to NASA) (Hughes Aircraft Co., Los Angeles) Filed 29 Mar. 1977 17 p Sponsored by NASA

(NASA-Case-GSC-12146-1; US-Patent-Appl-SN-782480) Avail: NTIS HC A02/MF A01 CSCL 09C

A microwave source of substantially constant amplitude drives a forward path connected between the source and the load. The forward path includes a voltage controlled, PIN diode, variable microwave attenuator. A feedback path responsive to the microwave power level in the forward path derives a control voltage for the PIN attenuator. The feedback path includes a microwave equalizer attenuator having an amplitude versus frequency response corresponding substantially with the amplitude versus frequency response of the load. The equalizer attenuator drives a linear, crystal amplitude detector. Attenuating means included in the forward and feedback paths are selectively connected in circuit to maintain the power level of the microwave input to the amplitude detector substantially constant, even though different power ranges are supplied to the load by the forward path. Author

N77-21323# Bendix Corp., Kansas City, Mo.

MANUFACTURING PROCESSES FOR HYBRID MICROCIRCUITS CONTAINING VIAS

D. Norwood, A. Laudel, and P. Blessner 1976 15 p refs Presented at IEEE 26th Electronics Components Conf., San Francisco, Apr. 1976

(Contract E(29-1)-613)

(BDX-613-1532; Conf-760414-5) Avail: NTIS HC A02/MF A01

Manufacturing processes were developed for making holes in alumina substrates, metallizing substrates on both sides and through vias, dry film photolithographing 6 micrometers thick gold to 5 mil (127 micrometers) line widths and spacing, and determining via quality and acceptance. The techniques developed produced vias with low resistance characteristics. Vias have been produced which exhibit through-hole resistances of less than 10 m omega and are acceptable for radio frequency of logic circuit application. Sample parts have been fabricated and evaluated on both test substrates and production substrates to prove-in the new techniques. An orbital planetary system which metallizes substrates on both sides and through the vias simultaneously is being characterized. ERA

N77-21324# Bendix Corp., Kansas City, Mo.

WIGGLY PHASE SHIFTERS AND DIRECTIONAL COUPLERS FOR RADIO FREQUENCY HYBRID MICROCIRCUIT APPLICATIONS

J. L. Taylor and D. D. Prigel Apr. 1976 9 p refs Presented at IEEE 26th Electronics Components Conf., San Francisco, Apr. 1976

(Contract E(29-1)-613)

(BDX-613-1524; Conf-760414) Avail: NTIS HC A02/MF A01

Packaging microwave hybrid microcircuits having combined electrical functions presented challenges in meeting space requirements without excessive signal interaction between microwave networks. The dispersive characteristics of microwave hybrid microcircuits were aggravated by the proximity of conductive materials, which places stringent requirements on packaging space and geometry. A space savings of 15 to 20 percent was achieved with the wiggly phase shifter and wiggly directional coupler. In addition, the performance of each device was significantly improved. The VSWR bandwidth of the phase shifter was doubled, and the directivity of the directional coupler was increased by 20 db. ERA

N77-21325# Los Alamos Scientific Lab., N. Mex.
ULTRA HIGH-CURRENT SUPERCONDUCTING CABLES FOR A 2.2-TESLA, 300-KILOJOULE ENERGY STORAGE MAGNET
Gilbert A. Miranda, R. Rhodenizer, P. Rackov, W. F. B. Punchard, and T. A. DeWinter 17 Aug. 1976 5 p refs Presented at Applied Superconductivity Conf., Stanford, Calif., 17 Aug. 1976
(Contract W-7405-eng-36)
(LA-UR-76-1809; Conf-760829-20) Avail: NTIS HC A02/MF A01

These 2.2-T, 300-kJ magnets are to operate at 10 to 12 kA with a safety factor in critical current of about 50 percent at 10 kA. The conductor exhibits low losses in addition tc being stable. A flat conductor was designed using 1224 copper-matrix, monofilament wires combined in two stages of cabling followed by two stages of flat braiding. Two of these conductors were constructed, one with wire already on hand and the second using wire made specifically for this application. Two rectangular conductors were using 315 and 319 mixed-matrix multifilament wires combined in three stages of cabling followed by compaction in a Turk's head. The maximum transport current capabilities of these cables were measured in hairpin shaped samples with the straight section under test in perpendicularly applied fields. ERA

N77-21326# Bendix Corp., Kansas City, Mo.
EVALUATION OF HIGH DENSITY BRAID TERMINATION FATIGUE LIFE AND CONDITION, MILESTONE REPORT
E. Belarde Aug. 1976 19 p refs Revised
(Contract E(29-1)-613)
(BDX-613-1435-Rev; PDO-6984751) Avail: NTIS HC A02/MF A01

A part of the total high-density, braided shield development work was devoted to evaluating electromagnetic radiation (EMR) braided shield solder terminations. Because field handling and excessive flexing of cables lowers the effectiveness of EMR shielding, fatigue failure data is essential for determining the life expectancy and future design of cables. Cables were bent vertically across a 0.375-in. (9.5 mm) mandrel (0 to 180 to 0 degrees) for 100 cycles. Wire breakage averaged about 16 percent of the braid. The test was repeated using a 0.50-in.-dia (12.7 mm) mandrel with breakage averaging about 12 percent. The impregnation of the braid with cellulose nitrate, where practical, creates a more uniform stress distribution and thereby increases the cable fatigue life. Efforts directed toward developing a technique for nondestructively evaluating the quality of the soldered braid termination proved promising. ERA

N77-21327# Bendix Corp., Kansas City, Mo.
FEASIBILITY STUDY OF DIODE PRECONDITIONING Final Report
J. P. Gracey Sep. 1976 34 p refs Revised
(Contract E(29-1)-613)
(BDX-613-1465-Rev; PDO-6989260) Avail: NTIS HC A03/MF A01

Investigations showed that it is feasible to precondition semiconductor diodes. Tests performed on four axial-lead, glass body diode types included high temperature reverse bias, power dc or ac burn-in, and temperature cycling. Although 10 minor failures occurred among the 800 diodes tested, indications are that no gross or unexpected reliability problems are present in the production inventories. ERA

N77-21328# Bendix Corp., Kansas City, Mo.
EXPOSURE STUDY FOR DRY-FILM PHOTORESISTS
M. L. Wilson Jun. 1976 26 p
(Contract E(29-1)-613)
(BDX-613-1469; PDO-6984684) Avail: NTIS HC A03/MF A01

Ultraviolet-light exposure settings were established for an exposure unit to provide optimum exposure for negative-acting dry-film photoresist types 6S, 16, and 30, as well as for types 110S and 116S. The amount of light undercut was determined for types 110S and 116S when used with both negative and positive phototools for the production of printed wiring boards. ERA

N77-21329# Bendix Corp., Kansas City, Mo.
NECESSITY OF CHARACTERIZING HYBRID MICROCIRCUIT ELEMENTS AT MICROWAVE FREQUENCIES
G. D. ODell Aug. 1976 13 p refs
(Contract E(29-1)-613)
(BDX-613-1477) Avail: NTIS HC A02/MF A01

As a result of efforts to develop packaging techniques for large radio frequency hybrid microcircuits (HMC), the need for characterization of such microcircuits became apparent. Characterization of hybrids and their manufacturing processes for radio frequency applications is required for economic production. Many of the present RF HMC circuits require extensive circuit adjustments to obtain desired function. The problems involved are partially the result of the lack of accurate RF characterization of the components and manufacturing processes as they relate to RF HMC applications. ERA

N77-21330# Bendix Corp., Kansas City, Mo.
DESIGN MANUAL FOR POTTING ELECTRONIC ASSEMBLIES
Sep. 1976 97 p refs Revised
(Contract E(29-1)-613)
(BDX-613-1216-Rev; PDO-6984462) Avail: NTIS HC A05/MF A01

A manual intended for practicing mechanical designers is presented. Hence, definition of engineering terms is minimized. Unless otherwise stated, the usual engineering definition of each term is intended. The manual gives a sound background of design practice for screening potting compounds, and quick overall design methods, basic formulations for detailed design, and design features both good and bad, so that the designer can sort and incorporate good design features at a preliminary stage. In addition, use of the manual should delete bad features from existing designs as life-test failures and service failures occur. ERA

N77-21331# Brookhaven National Lab., Upton, N.Y.
BROOKHAVEN SUPERCONDUCTING CABLE TEST FACILITY
E. B. Forsyth and R. J. Gibbs 17 Aug. 1976 5 p refs Presented at Applied Superconductivity Conf., Stanford, Calif., 17 Aug. 1976
(Contract E(30-1)-16)
(BNL-21780; Conf-760829-27) Avail: NTIS HC A02/MF A01

Construction has started on an outdoor testing station for flexible ac superconducting power transmission cables. The permanent equipment includes a 500 W supercritical helium refrigerator using a screw compressor and multistage turbine expanders. Helium storage for 250,000 cu ft of helium at 250 psi is provided. Initially, the cables will be tested in a horizontal cryostat some 250 ft long. The cable conductor will be energized by current transformers, initially at about 4 kA and later up to fault levels of 40 kA. ERA

N77-21332# Brookhaven National Lab., Upton, N.Y.
STUDIES OF HELICAL CONDUCTOR MODELS FOR SUPERCONDUCTING AC POWER TRANSMISSION
M. Garber, T. Barber, and G. Morgan 1976 4 p refs Presented at Appl. Superconductivity Conf., Stanford, Calif., 17-20 Aug. 1976 Sponsored in part by Elec. Power Res. Inst. and NSF
(Contract E(30-1)-16)
(BNL-21784; Conf-760829-28) Avail: NTIS HC A02/MF A01

In the BNL concept of a superconducting ac power transmission cable the conductors are made of Nb3Sn tapes wound helically on cylinders. Recently, it was decided to make each conductor in the form of a double layer winding in which the

layers are of opposite helicity. This reduces undesirable consequences of axial flux generation. After reviewing the considerations which lead to the double helix conductor, experiments with short models (0.8 m long) are described. Results are given for ac loss and quench current measurements. Quench currents in excess of 3,400 A/cm rms have been obtained. Ac losses are higher than those of short samples of the tapes used but are acceptable. Loss calculations for the double helix configuration are discussed. ERA

N77-21333# Los Alamos Scientific Lab., N. Mex.
ENERGY LOSSES IN MIXED MATRIX SUPERCONDUCTING WIRES UNDER FAST PULSED CONDITIONS
J. J. Wollan 17 Aug. 1976 5 p refs Presented at Applied Superconductivity Conf., Stanford, Calif., 17 Aug. 1976
(Contract W-7405-eng-36)
(LA-UR-76-1810; Conf-760829-19) Avail: NTIS HC A02/MF A01

Energy loses were measured on a set of mixed matrix (CuNi, Cu, NbTi) superconducting wires at B's up to 1.5 x 10 to the 7th power G/s. The losses were measured as a function of wire diameter, twist pitch, maximum applied field, and B. Both static and dynamic losses were measured for a field applied perpendicularly to the wire axis. The dynamic losses were measured by slowly applying an external field to a sample and then causing the field to decay exponentially in roughly 1 ms to 10 ms. Under low B (9 kG) and B (1 million G/s) conditions the hysteretic loss dominated. At high B (21 kG) and B (1.5 x 10 to the 7th power G/s) the matrix losses became dominant. ERA

N77-21334# Bendix Corp., Kansas City, Mo.
COVER EVALUATION FOR LARGE HYBRID MICROCIRCUITS Final Report
J. H. Williams Sep. 1976 15 p
(Contract E(29-1)-613)
(BDX-613-1500-Rev; PDO-6989231) Avail: NTIS HC A02/MF A01

Diallyl phthalate (DAP) was evaluated as a cover material for large HMCs but found unsuitable because DAP covers do not remain sealed to substrates during temperature cycling. Ceramic covers evaluated for the same application remained sealed during temperature cycling. The use of thermoplastic resins for sealing covers on HMCs was also evaluated, and General Mills' Versalon 1164 was the best general resin for the job because it has a slightly higher temperature requirement for complete softening and sealing. ERA

N77-21335# Bendix Corp., Kansas City, Mo.
CHARACTERIZATION OF CHROMIUM-GOLD FILMS FOR HYBRID MICROCIRCUITS Final Report
R. W. Pierce Sep. 1976 18 p refs
(Contract E(29-1)-613)
(BDX-613-1564-Rev) Avail: NTIS HC A02/MF A01

An existing chromium-gold electron beam evaporation system was evaluated for its ability to evaporate 6000 nm (60,000A) of gold to meet certain hybrid microcircuit specifications. The evaluation resulted in a new gold crucible design for the electron beam evaporation system. The new design ensures a longer crucible life and increases the gold evaporation rate by a factor of four. The gold film evaporated at the new rate was shown to meet the bondability, solderability, and resistivity requirements of certain hybrid microcircuits. ERA

N77-21336# Bendix Corp., Kansas City, Mo.
MINIATURE INTERCONNECTION DEVELOPMENT Final Report
D. L. Hollar Sep. 1976 14 p refs
(Contract E(29-1)-613)
(BDX-613-1651-Rev) Avail: NTIS HC A02/MF A01

Several specialized miniature interconnection methods were established and tested to minimize development hardware lead times and lower the cost of small design assemblies. A joining technique was developed for attaching a 33 AWG aluminum wire to a copper flexcircuit. Two miniature connector prototypes were designed--a multi-conductor low voltage connector and a two-conductor high voltage connector. A precision X-Y-Z mechanical positioner using a closed circuit television system was developed to allow electrode alignment for welding miniature parts. ERA

N77-21337# Bendix Corp., Kansas City, Mo.
IMPROVED PROCESS FOR IMPREGNATING HIGH VOLTAGE TRANSFORMERS Final Report
L. A. Wolfe Sep. 1976 39 p
(Contract E(29-1)-613)
(BDX-613-1650) Avail: NTIS HC A03/MF A01

High voltage transformers typically exhibit a 5 to 10% reject rate during corona and voltage breakdown tests because of incomplete impregnation. Sample coil assemblies were fabricated to provide data on the quality of four encapsulation processes: bench pour (pouring at atmospheric pressure and then deaerating), vacuum pour (placing units and material in a heated chamber and manually pouring under a vacuum), vacuum-pour-with-positive-pressure-cure (same as vacuum pour except a positive pressure curing was used), and an automated encapsulation system (impregnating materials are stored in vacuum containers located in a heated chamber and then metered through static mixers). Results show that an automated encapsulation system is equal to or better than the vacuum pour, vacuum-pour-with-positive-pressure-cure, and bench pour processes. ERA

N77-21338# Bendix Corp., Kansas City, Mo.
PLATING HYBRID MICROCIRCUITS Final Report
F. A. Clay Sep. 1976 18 p
(Contract E(29-1)-613)
(BDX-613-1575; PDO-6989266) Avail: NTIS HC A02/MF A01

A nonproprietary and a proprietary gold plating bath were investigated to determine if they were capable of producing thick (76 micrometer) films for RF hybrid microcircuits. Both solutions were found to produce high purity, soft gold deposits over a wide range of plating conditions. Test circuits plated with 6, 10, and 25 micrometer gold deposits passed the HMC production requirements of bondability, through-hole resistance, and other electrical characteristics. ERA

N77-21339# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
RELATIVISTIC DIODES IN CROSSED MAGNETIC FIELDS Progress Report, 1 Jun. 1975 - 15 Feb. 1976
G. Bekefi Feb. 1976 57 p refs
(Contract E(11-1)-2766)
(COO-2766-3) Avail: NTIS HC A04/MF A01

The behavior of a cylindrical field emission diode (radial potential approximately 200 kV) was studied in the presence of an externally applied axial magnetic field B less than or equal to 16 kG. Observations made of the space charge-limited electron current (approximately 50 kA) compare favorably with theory which takes into account the presence of both the external axial magnetic field and the azimuthal self-magnetic field generated by current flow in the cathode. At magnetic fields - exceeding the critical field necessary for cutoff, small but not insignificant current flows persist. The associated microwave emission suggests that this residual current is being driven by an as-yet-unidentified high frequency instability. Time-resolved measurements of the diode current and voltage lead to a determination of the expansion velocity of the cathode and anode plasmas. It was found that an external magnetic field of approximately 5 kG suffices to stop plasma motion. ERA

N77-21340# Sandia Labs., Albuquerque, N.Mex.
ELECTRICAL PROPERTIES OF DUPONT BIROX AND CERMALLOY THICK FILM RESISTORS. 3: ELECTRIC FIELD EFFECTS
C. H. Seager and G. E. Pike Aug. 1976 135 p refs
(Contract E(29-1)-789)
(SAND-76-0536) Avail: NTIS HC A07/MF A01

The response of three commercial thick film resistor systems to the application of square, high voltage pulses of varying width and height are reported. Other variables examined included pulse number, pulse polarity, and resistor temperature. ERA

N77-21341# Sandia Labs., Albuquerque, N.Mex.
IMPROVEMENT OF TRAPATT PERFORMANCE WITH OPTICALLY GENERATED CARRIERS

R. A. Kiehl and E. P. EerNisse 1976 15 p refs
(Contract E(29-1)-789)
(SAND-76-5778) Avail: NTIS HC A02/MF A01

It is demonstrated that a number of the difficulties which have thus far limited the application of the TRAPATT oscillator may be overcome by optically generating carriers within the device active region. Illumination with a short light pulse at the beginning of the bias pulse extends the ranges of bias, circuit tuning, and temperature over which the duration of leading edge jitter is short. Illumination during the application of the bias pulse significantly shifts the oscillation frequency. It is shown that this effect may be used to eliminate undesirable intrapulse frequency drift with shaped light pulse. Also, frequency switching in time-frames approaching one RF period are accomplished, which opens up new applications for the TRAPATT oscillator. ERA

N77-21342# Sandia Labs., Albuquerque, N.Mex.
SWITCHING DELAY OF THE CERMET VERSION OF THE MC2965
L. A. Shope and M. R. Heiser Sep. 1976 22 p refs
(Contract E(29-1)-789)
(SAND-76-0505) Avail: NTIS HC A02/MF A01

The cermet version of the MC2965 vacuum switch tube was tested in three different circuits to determine the dependency of the tube's switching delay and jitter on trigger current, anode voltage, and rate of rise of anode current. The results were then compared with two physical models of switch closure time - one dependent on the acceleration of metal vapor plasma and the second dependent on the formation time of multiple cathode spots. The closure time was found to be inversely dependent on the square root of the logarithm of trigger current, inversely dependent on the anode voltage, and directly dependent on the logarithm of the rate of rise of anode current. Switching time jitter was found to have similar dependencies. ERA

N77-21343# Sandia Labs., Albuquerque, N.Mex.
ADAPTIVE DIGITAL FILTER
G. R. Elliott, W. L. Jacklin, and S. D. Stearns Aug. 1976 33 p refs
(Contract E(29-1)-789)
(SAND-76-0360) Avail: NTIS HC A03/MF A01

It is a time-varying, autoregressive, linear system which can be used in system identification, signal enhancement, and linear prediction. In such applications it may often give remarkable results as compared to the performance of nonadaptive systems. The adaptive digital filter itself, some of the theory of operation, and examples of its use in projects are described. GRA

N77-21344# Sandia Labs., Albuquerque, N.Mex.
GOLD ALUMINUM INTERCONNECT STABILITY ON THIN FILM HYBRID MICROCIRCUIT SUBSTRATES
D. W. Bushmire Sep. 1976 26 p refs
(Contract E(29-1)-789)
(SAND-76-0306) Avail: NTIS HC A03/MF A01

Three different metallization systems were evaluated using three types of bonding wire. Tantalum-nitride-chromium-gold was bonded using 0.031 mm aluminum 1 percent Si wire and 0.031 mm aluminum 1 percent Mg wire. These two wire types were also bonded to substrates metallized with tantalum-nitride titanium-palladium-gold. Also, gold wire (0.025 mm) was bonded to aluminum metallization. These metallization-bond systems were evaluated by subjecting the test specimens to various known temperatures and time environments followed by loop pull tests to destruction, bond shear tests to destruction, and four point probe eletrical resistance measurements. The environments included: (1) 1000h of storage at 100 C, 200 C, and 300 C; and (2) temperature cycling from -40 C to 200 C for 10, 50, 100, 500, and 1000 cycles. The data show that the electrical resistance shows drastic increases long before mechanical integrity is degraded. ERA

N77-21345# Los Alamos Scientific Lab., N. Mex.
DISTRIBUTION OF MAXIMUM VOLTAGES IN MULTISECTION CAPACITOR WINDINGS AND IN CERTAIN SERIES-CONNECTED CAPACITORS
G. P. Boicourt May 1976 27 p refs
(Contract W-7405-eng-36)
(LA-6371) Avail: NTIS HC A03/MF A01

High-voltage energy-storage capacitors are constructed by assembling large numbers of subcapacitors in series parallel connections. The distribution of the overvoltages can be determined by using the statistical nature of the capacity variation. The basics of the calculation are reported, and Monte Carlo derived distributions are supplied that can be used to determine the distribution of maximum voltages in high voltage multisection capacitors. ERA

N77-21346# Leybold-Heraeus G.m.b.H., Hanau/Main (West Germany).
STUDY FOR THE MODIFICATION OF A MULTIFOIL RESISTANCE HEATED VACUUM FURNACE FOR MATERIAL SCIENCE EXPERIMENTS IN SPACE, VOLUME 2
1976 55 p 2 Vol.
(Contract ESA-SC/73-HQ)
(ESA-CR(P)-900-Vol-2) Avail: NTIS HC A04/MF A01

The possibility of producing a given temperature gradient in a multifoil resistance heated vacuum furnace for use onboard Spacelab was investigated, based on a previously designed furnace. It was found that this furnace can only be used as a gradient furnace after considerable modifications. It is suggested, therefore, to use a special separate gradient furnace with an annular heater, screened by multifoil insulation, in order to obtain a very well defined heating zone. The heater and its insulation are in vacuum. Rate of heating is 20 C/sec. This furnace allows the zone melting of crystals and is designed for a continuous power consumption of 200 W. The effects of the ultrasonic transducer upon the temperature distribution were investigated; power supply requirements are stated. ESA

N77-21347# Royal Aircraft Establishment, Farnborough (England).
AN INVESTIGATION OF THE INITIATION OF HOLLOW CATHODE DISCHARGES
D. G. Fearn, Angela S. Cox, and D. R. Moffitt Apr. 1976 47 p refs
(RAE-TR-76054; BR53368) Avail: NTIS HC A03/MF A01

Extensive investigations of the starting characteristics of hollow cathodes reveal that this is a random process, dependent on temperature, mercury vapor flow rate, voltage, geometry, and the availability of a low work function material. For a given cathode and fixed conditions, the voltage necessary to start a discharge falls at random within a certain range. As temperature or flow rate are increased, the maximum value and width of this voltage range both decrease until, at high values, starting is reproducible at potentials often below 20 V. A qualitative explanation of the results at high flow rate is proposed in terms of collisional ionization of the vapor by thermionically emitted electrons. At lower flow rates, it is necessary to include electron reflection from the keeper electrode and, at the lowest flows, a vacuum arc mechanism. Success was achieved in initiating discharges using internal electrodes, employing either low positive voltages or much higher negative potentials. In the former case, it was difficult to transfer the internal discharge through the cathode orifice to the keeper. Author (ESA)

N77-21348# Royal Aircraft Establishment, Farnborough (England).
A DIGITAL FREQUENCY SYNTHESIZER-DIVIDER USING A PHASE LOCK LOOP CONTROL SYSTEM
J. Lillie Oct. 1976 20 p refs
(RAE-TM-RAD-NAV-43; BR54979) Avail: NTIS HC A02/MF A01

The design of a digital frequency synthesizer-divider using a phase lock loop control system is described. The device is for laboratory use as a programmable frequency source having a stable output. Author (ESA)

N77-21349# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
SOLID STATE ARRAY STUDIES RELEVANT TO OTP REGULATIONS. PART 1: EVALUATION OF AMPLITUDE AND PHASE CHARACTERISTIC OF MICROWAVE SOLID STATE AMPLIFIER Interim Report, Sep. 1974 - Feb. 1976
Donald W. Griffin Griffiss AFB, N. Y. RADC Aug. 1976 221 p refs

(Contract F30602-75-C-0121; AF Proj. 9567)
(AD-A032130; RADC-TR-76-241-Pt-1) Avail: NTIS HC A10/MF A01 CSCL 09/5

A study has been made of microwave amplifier modules designed for phased array antenna service. Output amplitude and phase behavior have been measured under mismatched load conditions at fundamental and harmonic frequencies. A bridge has been used that is capable of being balanced at fundamental, second and third harmonics. Reference signals at these frequencies are adjusted in amplitude and phase to cancel the corresponding components produced by the amplifier under test. The amplitude and phase variations of the waves travelling out of the amplifier are measured as a function of load mismatch. A standard test load is used to present to the amplifier output the impedances that lie on a selected series of VSWR circles on a Smith chart. The test load is not a replica of the dynamic impedance of any particular chosen element in a phased array, but the data gathered can be used to provide amplitude and phase data for radiation pattern calculations if the dynamic impedance of each antenna element is known. Results obtained using the load are presented as equi-power and equi-phase contours in the overall region of load variation. L- and S-band bipolar transistor modules designed for phased array antenna service and various experimental S-band TRAPATT amplifiers have been studied. GRA

N77-21350# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
SOLID STATE ARRAY STUDIES RELEVANT TO OTP REGULATIONS. PART 2: RANDOM EFFECTS IN PLANAR ARRAYS OF DIPOLES Interim Report, Sep. 1974 - Feb. 1976
Arlan T. Adams, Peter Hsi, and A. Farrar Griffiss AFB, N. Y. RADC Aug. 1976 165 p refs
(Contract F30602-75-C-0121; AF Proj. 9567)
(AD-A032131; RADC-TR-76-241-Pt-2) Avail: NTIS HC A08/MF A01 CSCL 09/5

A computer program for the analysis of random effects in planar arrays is described. The method of moments is applied iteratively in conjunction with a random sampling process, to obtain mean far field beam patterns and their expected variation. Block-Toeplitz impedance redundancies and the zeros of the excitation matrix are utilized in a special efficient solution routine. Separate array analysis at fundamental and harmonic frequencies yields the expected ratio of harmonic to fundamental levels. The theory of the computer program is outlined, and typical results are presented. Significant gain degradation is predicted at harmonic frequencies. The results are applied to the OTP regulations, and it is concluded that certain types of microwave solid state devices tested are viable candidates for array elements in view of these regulations. Author (GRA)

N77-21351# Communications Research Centre, Ottawa (Ontario). Radio and Radar Branch.
BEVERAGE ANTENNAS FOR HF COMMUNICATIONS, DIRECTION FINDING AND OVER-THE-HORIZON RADARS
J. Litva and B. J. Rook Aug. 1976 188 p refs
(AD-A031787; CRC-1282) Avail: NTIS HC A09/MF A01 CSCL 09/5

A detailed description is given of the experimental and theoretical results obtained from a study of the Beverage antenna. The results show that this antenna is useful as a receiving antenna in the high frequency range because it is highly directive, largely frequency independent, has a low take-off angle and is relatively inexpensive to construct. Since the electrical properties of the ground over which HF antennas may be situated will affect their performance, a novel technique is described, which utilizes a single Beverage element to determine these properties. Comprehensive Beverage antenna engineering-design-data have been calculated and tabulated in a readily accessible format for the communications engineer. Beverage antennas are shown to be effective elements or 'building blocks' for HF antenna systems, such as rosette and linear antenna arrays. GRA

N77-21352# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
AN INTEGRATED CIRCUIT FAULT MODEL FOR DIGITAL SYSTEMS Ph.D. Thesis
Mark Loren Ketelsen Sep. 1976 152 p refs
(Contract DAAB07-72-C-0259)
(AD-A031431; UILU-ENG-76-2231; R-743) Avail: NTIS HC A08/MF A01 CSCL 09/2

A model for the faulty behavior of digital networks realized using integrated circuit devices is proposed. This model, the pin fault assumption, is based on a study of the most frequently encountered failure mechanisms for such networks, and the observation that previous fault assumptions model a large number of faults which occur with low frequency. The basis for the pin fault model, and an investigation of multiple fault detection using this model are presented. Fault detection for combinational modules is investigated, and it is shown that multiple pin fault detection test sets for such modules may be quite easily generated. The computation required to generate such test sets is independent of the circuit realization internal to the model, and each test generated requires about the same amount of computation. The computational complexity of test generation is greatly reduced compared to that for previously studied fault models. Pin fault detection experiments for sequential machines are studied, and methods for designing such experiments are developed. These design methods are compared to those under other fault assumptions, and a substantial reduction is observed in the length of such sequences and the computation required to produce them. Author (GRA)

N77-21353# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
THE DESIGN OF TOTALLY SELF-CHECKING COMBINATIONAL CIRCUITS Ph.D. Thesis
James Edward Smith Aug. 1976 147 p refs
(Contract DAAB07-72-C-0259)
(AD-A031430; UILU-ENG-76-2225; R-737) Avail: NTIS HC A07/MF A01 CSCL 09/2

The output reliability of logic circuits can be increased by constructing them such that they are 'totally self-checking.' Totally self-checking circuits have their outputs encoded in an error-detecting code. By considering the modeling of potential hardware failures, circuit structure and output code, it is possible to construct circuits such that a failure within the circuit is indicated by a noncode output, and a code output indicates that the output is correct. This thesis discusses the relationship between hardware faults, circuit structures, and output codings. The 'path-fault secure' property is introduced and is used to develop a systematic design method for totally self-checking combinational circuits. The method places little restriction on the types of faults which may be assumed. Its applications to circuits with single and unidirectional fault assumptions are described in detail. In addition, other concepts are discussed which deal primarily with the interconnection of small totally self-checking circuits to form larger ones. These concepts also lead to systematic methods for constructing totally self-checking check circuits. Author (GRA)

N77-21354# Westinghouse Electric Corp., East Pittsburgh, Pa.
ECOLOGICAL INFLUENCE OF ELECTRIC FIELDS Interim Report
H. A. Kornberg Sep. 1976 46 p refs
(PB-260641/6; EPRI-EA-178) Avail: NTIS HC A03/MF A01 CSCL 06F

Preliminary results of studies of effects of electric fields on plants, voles, chicks, and chicken embryos are presented. Electric fields no greater than 17.2 kilovolts/meter are anticipated 2m above ground level underneath 1,500 kilovolts transmission lines. Plant leaf tip damage was observed for certain pointed leaves at field intensities at or greater than 25 kilovolts/meter. No leaf tip damage was observed at field strengths at 20 kilovolts/meter or less. Damage observed was minor in extent. Meadow voles were exposed to 50 kilovolts/meter fields for periods up to 4 weeks. No statistically significant effects of this exposure were observed. GRA

N77-21355# California Univ., Berkeley. Dept. of Physics.
PARAMETRIC AMPLIFICATION AND OSCILLATION AT 36 GHz USING A POINT CONTACT JOSEPHSON JUNCTION Technical Report, 1 Feb. 1976 - 31 Jan. 1977
Y. Taur and P. L. Richards Nov. 1976 28 p refs
(Contract N00014-75-C-0496)

(AD-A031895) Avail: NTIS HC A03/MF A01 CSCL 20/12

We have observed doubly degenerate parametric amplification and oscillation at 36 GHz from a single point contact Josephson junction. The experimental results agree qualitatively with theoretical calculations based on the resistively shunted junction model. The estimated noise temperature of an amplifier with 11 db net gain is consistent with zero, but has an upper limit of 50 K. Attempts to observe parametric amplification in the singly degenerate mode with a pump frequency of 72 GHz were not successful. Author (GRA)

N77-21356# Energy Development Associates, Madison Heights, Mich.

EVALUATION OF A 1 KWH ZINC CHLORIDE BATTERY SYSTEM Interim Report

P. C. Symons, M. J. Hammond, and J. Birk Sep. 1976 62 p refs Sponsored by Electric Power Research Inst.

(PB-260683/8; EPRI-EM-249) Avail: NTIS HC A04/MF A01 CSCL 10C

A 1kWh zinc-chlorine battery was constructed and evaluated for 100 cycles to determine the technical feasibility of this battery system for utility application. The battery was tested under operating conditions appropriate to the peaking application--approximately a 4 hour charge, 4 hour discharge cycle. The battery system uses zinc and chlorine as the active electrode materials, employs an aqueous circulating electrolyte, and is operated near ambient temperature. The chlorine is stored external to the battery as chlorine hydrate, a frozen ice-like material. The high electrochemical energy efficiency is consistent with the goals for this application. GRA

N77-21357# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.

FM RANGING USING A FREQUENCY REACTION CORRELATOR

Marion C. Bartlett, Raymond C. Johnson, and Leon W. Couch Oct. 1976 47 p refs

(AD-A033434; HDL-CR-76-043-1) Avail: NTIS HC A03/MF A01 CSCL 17/9

A new type of IF correlator FM ranging system which uses the frequency reaction of an oscillator is described. This system is called a Frequency Reaction Correlator and correlates an IF signal that results from the frequency reaction of the oscillator with an IF reference developed with an RF delay line and mixer. The RF delay line and mixer serves simultaneously to (1) detect the IF signal, (2) develop an IF reference, and (3) correlate the IF signal and reference. To analyze the Frequency Reaction Correlator, a model which describes the amplitude and frequency reactions of a compliant frequency modulated oscillator due to an injected signal is developed. Possible applications of the Frequency Reaction Correlator include doppler ranging, directional doppler ranging, and remote sensing or telemetering. A digital technique for implementing the Frequency Reaction Correlator is discussed. Mathematical analyses and experimental data are presented and are shown to be in agreement. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N77-21358 Engineering Sciences Data Unit, London (England).

INTRODUCTION TO DESIGN AND PERFORMANCE DATA FOR DIFFUSERS Data Item

Nov. 1976 33 p

(ESDU-76027; ISBN-0-85679-164-4) For information on availability of series, sub-series, or individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. (write for prices)

A comprehensive survey of diffuser performance is given. It gives background information and assesses the effects of geometrical and flow variables on diffuser performance and the possibility of improvement of existing designs. ESDU

N77-21359*# Stanford Univ., Calif. Thermosciences Div.

EVALUATION OF SUBGRID-SCALE TURBULENCE MODELS USING A FULLY SIMULATED TURBULENT FLOW

R. A. Clark, J. H. Ferziger, and W. C. Reynolds Mar. 1977 128 p refs

(Grant NGR-05-020-622)

(NASA-CR-152642; SU-TF-9) Avail: NTIS HC A07/MF A01 CSCL 20D

An exact turbulent flow field was calculated on a three-dimensional grid with 64 points on a side. The flow simulates grid-generated turbulence from wind tunnel experiments. In this simulation, the grid spacing is small enough to include essentially all of the viscous energy dissipation, and the box is large enough to contain the largest eddy in the flow. The method is limited to low-turbulence Reynolds numbers, in our case R sub lambda = 36.6. To complete the calculation using a reasonable amount of computer time with reasonable accuracy, a third-order time-integration scheme was developed which runs at about the same speed as a simple first-order scheme. It obtains this accuracy by saving the velocity field and its first-time derivative at each time step. Fourth-order accurate space-differencing is used. Author

N77-21360*# Aerojet Liquid Rocket Co., Sacramento, Calif.

COMBUSTION EFFECTS ON FILM COOLING Final Report, 20 May 1974 - 31 Jul. 1975

D. C. Rousar and R. L. Ewen 24 Feb. 1977 195 p refs

(Contract NAS3-17813)

(NASA-CR-135052) Avail: NTIS HC A09/MF A01 CSCL 20D

The effects of: (1) a reactive environment on film cooling effectiveness, and (2) film cooling on rocket engine performance were determined experimentally in a rocket thrust chamber assembly operating with hydrogen and oxygen propellants at 300 psi chamber pressure. Tests were conducted using hydrogen, helium, and nitrogen film coolants in an instrumented, thin walled, steel thrust chamber. The film cooling, performance loss, and heat transfer coefficient data were correlated with the ALRC entrainment film cooling model which relates film coolant effectiveness and mixture ratio at the wall to the amount of mainstream gases entrained with the film coolant in a mixing layer. In addition, a comprehensive thermal analysis computer program, HOCOOL, was prepared from previously existing ALRC computer programs and analytical techniques. Author

N77-21361*# Scientific Translation Service, Santa Barbara, Calif.

PROGRESS IN THE CALCULATION METHODS OF TWO- AND THREE-DIMENSIONAL TURBULENT BOUNDARY LAYERS

J. Cousteix Washington NASA Apr. 1977 75 p refs Transl. into ENGLISH of Conf. paper from Office National d'Etudes et de Recherches Aerospatiales (Toulouse), 1976 28 p Presented at 13th Colloq. of Appl. Aerodynamics, Lyon, 8-10 Nov. 1976 (Contract NASw-2791)

(NASA-TT-F-17415) Avail: NTIS HC A04/MF A01 CSCL 20D

A review of the main types of methods for calculating turbulent flows is presented as they apply to boundary layer prediction. Their performances are evaluated by comparisons with various experiments in two-dimensional flow. The use of these methods is also discussed in the case of three-dimensional boundary layers. Author

N77-21362# Brown Univ., Providence, R. I. Div. of Applied Mathematics.

COMPRESSIBLE STRATIFIED FLOWS OVER A LONG OBSTACLE

William Stevens and C. H. Su Mar. 1977 26 p refs

(Contract N00014-76-C-0924; Grant NSF DES-75-12853)

Avail: NTIS HC A03/MF A01

Steady two dimensional stratified shear flows of a compressible fluid over a mountain are studied with the long wave assumption (hydrostatic balance). For constant entropy profile far upstream, a close form solution was obtained. For general stratification and shear, the speed of certain points in the flow may vanish. These points were treated as the birth-bed of flow fields with closed streamlines (recirculating region). Constants of motion along a streamline were used to construct the outer

boundary of these regions. Numerical solutions with data upstream to the the Rocky Mountains were constructed with the recirculating region in the flow field. Author

N77-21363*# Fluid Mechanics and Thermal Systems, Inc., Waverly, Ala.
COMBUSTION OF HYDROGEN INJECTED INTO A SUPERSONIC AIRSTREAM (THE SHIP COMPUTER PROGRAM) Final Report
N. C. Markatos, D. B. Spalding, and D. G. Tatchell Washington NASA Apr. 1977 127 p refs Supersedes NASA-CR-2655 (Contract NAS1-14301)
(NASA-CR-2802) Avail: NTIS HC A07/MF A01 CSCL 20D

The mathematical and physical basis of the SHIP computer program which embodies a finite-difference, implicit numerical procedure for the computation of hydrogen injected into a supersonic airstream at an angle ranging from normal to parallel to the airstream main flow direction is described. The physical hypotheses built into the program include: a two-equation turbulence model, and a chemical equilibrium model for the hydrogen-oxygen reaction. Typical results for equilibrium combustion are presented and exhibit qualitatively plausible behavior. The computer time required for a given case is approximately 1 minute on a CDC 7600 machine. A discussion of the assumption of parabolic flow in the injection region is given which suggests that improvement in calculation in this region could be obtained by use of the partially parabolic procedure of Pratap and Spalding. It is concluded that the technique described herein provides the basis for an efficient and reliable means for predicting the effects of hydrogen injection into supersonic airstreams and of its subsequent combustion. Author

N77-21364*# Washington State Univ., Pullman. Dept. of Computer Science.
AN INVESTIGATION OF CONDENSATION HEAT TRANSFER IN A CLOSED TUBE CONTAINING A SOLUBLE NONCONDENSABLE GAS Final Report
Elric W. Saaski and Richard J. Hanson [1976] 82 p refs (Grant NsG-2015)
(NASA-CR-137811) Avail: NTIS HC A05/MF A01 CSCL 20D

An exact one-dimensional condensation heat transfer model for insoluble gases has been developed and compared with experimental data. Modifications to this model to accommodate soluble gas behavior have also been accomplished, and the effects on gas front behavior demonstrated. Analytical models for condensation heat transfer are documented, and a novel optical method used for measuring gas concentration profiles is outlined. Author

N77-21365# San Jose State Univ., Calif. Dept. of Meteorology.
MASS TRANSPORT ACROSS A TEMPERATURE INVERSION
Jindra K. Goodman and Albert Miller Nov. 1976 51 p refs (Grants NSF-ATM-74-08017-A01; NSF DES-71-00632-A01) (Rept-76-10) Avail: NTIS HC A04/MF A01

Vertical transport of mass both within and across the interface of the west coast temperature inversion is discussed. The vertical transport is ascribed to internal gravity waves. Although usually dynamically stable, transient waves moving through a layer of strong vertical shear of the horizontal wind produce extensive horizontal mixing near their crests, resulting in a vertical pumping of mass. The apparent vertical diffusion coefficient is not insignificant for large Richardson number, although it decreases with increasing Ri. Author

N77-21366*# Hamilton Standard, Windsor Locks, Conn.
DESIGN, DEVELOPMENT, AND FABRICATION OF A PROTOTYPE ICE PACK HEAT SINK SUBSYSTEM. POTASSIUM BIFLUORIDE/WATER SOLUTION INVESTIGATIONS Final Report
George J. Roebelen, Jr. and Jordan D. Kellner Feb. 1977 85 p
(Contract NAS2-8665)
(NASA-CR-151982; SVHSER-7163) Avail: NTIS HC A05/MF A01 CSCL 20D

A series of investigations was conducted to characterize the physical properties of potassium bifluoride and water solutions for use as the fusible heat sink material in a regenerable portable life support system. Author

N77-21367# Technische Hogeschool, Delft (Netherlands).
MEMORY EFFECTS IN TURBULENT FLOWS Ph.D. Thesis
P. J. H. Builtjes Apr. 1977 129 p refs
(WTHD-97) Avail: NTIS HC A07/MF A01 CSCL 20D

Extra memory effects on relaxation time were investigated. Experiments were done in a turbulent boundary-layer disturbed by a half sphere, in the region just downstream of a cylinder and in the region just behind a grid. The mean velocity, the turbulence intensities, the turbulent shear stress, energy spectra, space-time correlations and some of the probability distributions were measured. Author

N77-21368*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRESSURE DISTRIBUTIONS INDUCED BY ELEVON DEFLECTIONS ON SWEPT WINGS AND ADJACENT END-PLATE SURFACES AT MACH 6
Louis G. Kaufman, II (Grumman Aerospace Corp., Bethpage, N. Y.) and Charles B. Johnson Washington Apr. 1977 124 p refs
(NASA-TM-X-3470; L-11090) Avail: NTIS HC A06/MF A01 CSCL 01A

Surface pressure distributions are presented for regions where three-dimensional separated flow effects are prominent on swept-wing-elevon-end-plate models of 0 degree, 50 degree, and 70 degree sweepback, and with 0 degree, 10 degree, 20 degree, and 30 degree elevon deflections. Surface-oil-flow photographs and pressure distributions on the flat-plate wing, elevon, and end-plate surfaces are presented for numerous geometric variations, including various spacings between the elevon and the end plate, with and without a tip fin. The data, for a free-stream Mach number of 6 and a wing-root-chord Reynolds number of 20 x 10 to the sixth power, reveal considerably larger regions of elevon induced loads on the adjacent end-plate surface than would be anticipated by using inviscid flow analyses. Author

N77-21369# Sandia Labs., Albuquerque, N.Mex.
ONE-DIMENSIONAL MODEL OF STEADY, COMPRESSIBLE CHANNEL FLOW WITH MASS, MOMENTUM, AND ENERGY ADDITION
S. C. Johnston Sep. 1976 48 p refs
(Contract E(29-1)-789)
(SAND-76-8244) Avail: NTIS HC A03/MF A01

An exact solution to the governing equations was found, and from it a similarity parameter relating dimensionless mass, momentum and energy addition identified. This similarity parameter is used to make two flows having different dimensionless mass, momentum and energy additions equivalent. Analysis indicates that the Sandia experiment can realistically simulate the energy addition in the LASL intense neutron source experiment. ERA

N77-21370# Los Alamos Scientific Lab., N. Mex.
SOLA-ICE: A NUMERICAL SOLUTION ALGORITHM FOR TRANSIENT COMPRESSIBLE FLUID FLOWS
L. D. Cloutman, C. W. Hirt, and N. C. Romero Feb. 1976 47 p refs
(Contract W-7405-eng-36)
(LA-6236) Avail: NTIS HC A03/MF A01

A finite difference technique is presented for solving the equations of motion for an arbitrarily compressible fluid. The technique, which includes the implicit continuous-fluid Eulerian (ICE) method as an optional feature, is simplified to facilitate its use by persons with little or no experience in numerical fluid dynamics. The basic algorithm, some accuracy and stability considerations, a flow chart, a FORTRAN listing, and three test problems are described. ERA

N77-21371# Los Alamos Scientific Lab., N. Mex.
BAAL: A CODE FOR CALCULATING THREE-DIMENSIONAL FLUID FLOWS AT ALL SPEEDS WITH AN EULERIAN-LAGRANGIAN COMPUTING MESH
W. E. Pracht and J. U. Brackbill Apr. 1976 95 p refs

(Contract W-7405-eng-36)
(LA-6342) Avail: NTIS HC A05/MF A01

A technique for computing the time-dependent dynamics of three-dimensional fluid flows is presented. The finite difference solution procedure is based upon an arbitrary Lagrangian-Eulerian computing mesh whose vertices may move with the fluid (Lagrangian), remain fixed (Eulerian), or move in any prescribed manner. An implicit treatment of the pressure makes the method applicable to flows at all speeds, from far subsonic to far supersonic. The marker particles used may follow the motion of the fluid exactly to aid in flow visualization, or may represent particulate matter whose behavior is affected by inertia, drag, gravity, and diffusion. A derivation is included for generalized difference equations and their incorporation into a program called BAAL, for which portions of a FORTRAN listing are provided. Several sample calculations illustrate some of the uses and the flexibility of this new three-dimensional computing technique.
ERA

N77-21372# Los Alamos Scientific Lab., N. Mex.
SYMMETRY BREAKING IN FLUID DYNAMICS: LIE GROUP REDUCIBLE MOTIONS FOR REAL FLUIDS Ph.D. Thesis - Michigan Univ.
D. D. Holm Jul. 1976 231 p refs
(Contract W-7405-eng-36)
(LA-6392-T) Avail: NTIS HC A11/MF A01

The physics of fluids is based on certain kinematical invariance principles, which refer to coordinate systems, dimensions, and Galilean reference frames. Other, thermodynamic, symmetry principles are introduced by the material description. In the present work, the interplay between these two kinds of invariance principles is used to solve for classes of one dimensional nonsteady isentropic motions of a fluid whose equation of state is of Mie-Gruneisen type. Also, the change in profile and attenuation of weak shock waves in a dissipative medium is studied at the level of Burgers' approximation from the viewpoint of its underlying symmetry structure. The mathematical method of approach is based on the theory of infinitesimal Lie groups. Fluid motions are characterized according to inequivalent subgroups of the full invariance group of the flow description and exact group reducible solutions are presented.
ERA

N77-21373# Laboratoire d'Aerothermique du C.N.R.S., Meudon (France).
BALANCE EQUATIONS OF AN INTERFACE SUBJECT TO WEAK PERTURBATIONS [EQUATIONS DE BILAN D'UNE INTERFACE SOUMISE A DE FAIBLES PERTURBATIONS]
Michel Dudeck May 1976 26 p refs In FRENCH
(Rept-76-3; Publ-524) Avail: NTIS HC A03/MF A01

The problem of an interfacial surface adjacent to a weakly moving plane surface is dealt with. During its movement, this surface may become deformed, but the resulting amplitude of the perturbation is supposed weak compared to the characteristic length of the phenomenon. The balance equations in all the phases adjacent to the interface are coupled to the balance equations of the interfacial medium, considered as having no thickness but possessing internal properties. These equations are developed according to the growing powers of a parameter characterizing the amplitude of the interfacial perturbation. The results are applied to the calculation of the various terms of the general interfacial balance equation.
ESA

N77-21374# Laboratoire d'Aerothermique du C.N.R.S., Meudon (France).
BALANCE EQUATIONS OF A CONDUCTIVE MEDIUM WITH AN ELECTROMAGNETIC FIELD [EQUATIONS DE BILAN D'UN MILIEU CONDUCTEUR AVEC CHAMP ELECTROMAGNETIQUE]
R. Prudhomme and M. Dudeck May 1976 96 p refs In FRENCH; ENGLISH summary
(Rept-76-2; Publ-518) Avail: NTIS HC A05/MF A01

The principal equations of chemically reacting and electrically conducting fluid flows are discussed. The balance equations were established for homogeneous media, with or without polarization. The expressions of fundamental quantities as the electromagnetic field and the impulse energy are given. The interfacial conservation equations of the nonpolarized media were established. In the case of polarized media, the same formalism was used to prove the Maxwell equations at the interface. These equations were examined more accurately in view of applications. The method developed is used to study thermoelectric effects in metals.
Author (ESA)

N77-21375# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
DEGRADATION OF THERMAL CONTROL COATINGS BY ULTRAVIOLET AND PARTICLE IRRADIATION EFFECTS Final Report [ETUDE DES DEGRADATIONS DE REVETEMENTS DE CONTROLE THERMIQUE SOUS L'EFFET DES RAYONNEMENTS ULTRAVIOLETS ET PARTICULAIRES]
J. Bourrieau, A. Paillous, and Manola Romero Oct. 1976 127 p refs In FRENCH
(Contract ESTEC-2515/75-HP)
(ESA-CR(P)-892) Avail: NTIS HC A07/MF A01

An analysis is presented of thermal control coating degradation by ultraviolet, electron, or proton irradiation based on existing literature. Results of ultraviolet irradiation of the same material are very dispersed since wavelengths and light sources may vary. The influence of intensity or temperature is also noted. Results of electron or proton irradiation seem compatible notwithstanding their apparent dispersion. It is shown that variation of the optical absorption coefficient is directly linked to the average value of the energy dose absorbed in the degraded material layer. The effects of temperature and intensity are noted also in this case. The information can be used to select the best simulation conditions. An experimental and thermal study program is proposed.
ESA

N77-21376# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AERODYNAMIC STUDY OF FLOW IN CAVITIES WITH WALL INJECTION Ph.D. Thesis - Paris 6 Univ.
Jacques Chaumette Dec. 1976 85 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-372)
(ONERA-NT-1976-9; FR-ISSN-0078-3781) Avail: NTIS HC A05/MF A01

The steady flow within a cavity fed through its wall (case of solid propellant grains obtained by machining) was investigated theoretically and experimentally. The influence of the flow issued from a wall cavity on the main two-dimensional flow was examined, and the interaction of two perpendicular flows was studied, distinguishing several cases according to the assumptions made on the stagnation pressures and the downstream conditions. The fluid was assumed incompressible and inviscid. The flow within cavities, fed through their wall, was studied. A hydraulic simulation on a two-dimensional model and a visualization of the flow of burnt gases in a small combustor with a window, containing a machined propellant grain, made it possible to lift indeterminations on geometric singularities. In the theoretical study, the fluid was assumed incompressible. The assumption of an irrotational flow leads to a physically unacceptable solution. A more thorough study of the boundary layer with injection shows that, in the case of large Reynolds number, the solution of the real problem may be obtained by assuming the fluid ideal and the flow rotational. The equation of rotational transport was solved and, to this end, a numerical method was used based on discrete singularities, in two-dimensional flow. The theoretical results are in good agreement with experiment. This numerical method was generalized to the case of axisymmetrical flows, and the results obtained for the pressure in the rocket engine compared to experimental results described in the literature.
Author (ESA)

N77-21377# Royal Aircraft Establishment, Farnborough (England). Dept. of Aerodynamics.
APPLICATION OF HEAD'S ENTRAINMENT METHOD TO THE PREDICTION OF TURBULENT BOUNDARY LAYERS AND WAKES IN COMPRESSIBLE FLOW
J. E. Green London Aeron. Res. Council 1976 34 p refs Supersedes RAE-TR-72079; ARC-34052
(ARC-R/M-3788; RAE-TR-72079; ARC-34052) Avail: NTIS HC A03/MF A01; HMSO £2.90; PHI $11.30

Details are given of an adaptation of Head's entrainment method to compressible flow which has been in use in R.A.E.

since 1967. The main feature of the method is that it has been tied to the flat plate skin-friction correlation of Spalding and Chi, so that its accuracy in zero pressure gradient is assured. Other innovations are the introduction of a simple explicit two-parameter approximation to two more elaborate but implicit skin-friction relations, and the extension of the method to treat aerofoil wakes. Comparisons with experiment are shown to support these extensions. In appendices, further, untried refinements of the method are presented, and a tentative treatment of compressible flows with heat transfer is given. Author (ESA)

N77-21378# Royal Aircraft Establishment, Farnborough (England). Dept. of Aerodynamics.

SOME RESULTS ON THE GROWTH OF INSTABILITIES IN A SHEAR LAYER

Ann P. Dowling London Aeron. Res. Council 1976 31 p refs Supersedes RAE-TR-76008; ARC-36747

(ARC-CP-1359; RAE-TR-76008; ARC-36747) Avail: NTIS HC A03/MF A01; HMSO £.50; PHI $5.80

The linear spatial stability of a mixing layer between two parallel streams is considered, and a comparison is made between the stability of flows with and without a stationary splitter plate separating them upstream. The assumed velocity profile satisfies the condition of no slip on the splitter plate, but in other respects the flow is treated as inviscid. Account is taken of the jet spreading downstream, and expressions are obtained for the total amplification of an infinitesimal disturbance of a particular frequency as it travels downstream. The stability of a hot air jet is compared to that of a cold air jet with the same velocity profile. Author (ESA)

N77-21379# Institut Franco-Allemand de Recherches, St. Louis (France).

METHODS FOR THE INVESTIGATION OF BLASTWAVES IN A GALLERY NETWORK [METHODES D'ETUDE DE LA PROPAGATION D'UNE ONDE DE SOUFFLE DANS UN RESEAU DE GALERIES: SYNTHESE DE DONNEES BIBLIOGRAPHIQUES]

L. Bobin 21 Jul. 1975 62 p refs In FRENCH Supplement to ISL-NB-4/73

(Contract DTEn-74-70-161)

(ISL-NB-401/75; ISL-NB-4/73) Avail: NTIS HC A04/MF A01

Various problems related to the propagation of blastwaves in an underground gallery network are discussed, namely, the physical phenomenon of the blastwave, its penetration into a gallery network, propagation into galleries with or without obstacles, and effect of a lateral gallery branching. ESA

N77-21380# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Experimentelle Aerodynamik.

EXPERIMENTAL INVESTIGATION OF THE FIELD DOWNSTREAM OF A PLANE TURBINE CASCADE IN TRANSONIC FLOW

R. Kiock Jan. 1977 18 p refs Presented at the Symp. Meas. Tech. in Transonic and Supersonic Cascade Flow, Lausanne, Switz., 18-19 Nov. 1976

(DLR-IB-151-77/1) Avail: NTIS HC A02/MF A01

The measurement of total pressure, static pressure, and flow angle at several distances close behind a turbine cascade is described. Average values were evaluated from these local values by means of the laws of conservation. The flow field is discussed on the basis of these wake flow quantities and of Schlieren pictures. Investigations were carried out in the high speed cascade wind tunnel at an isentropic Mach number 1.00 and at a Reynolds number of 10 to 5th power. Author (ESA)

N77-21381# Technological Lab. RVO-TNO, Rijswijk (Netherlands).

INVESTIGATION OF DETONATION CHAINS. PART 5: SHOCKWAVE CALIBRATION OF THE SYSTEMS PWL (PLANE WAVE LENS) - PLEXIGLASS AND TETRYL-PLEXIGLASS [ONDERZOEK DETONATIEKETENS. DEEL 5. DE SCHOKGOLFDRUK-IJKING VAN DE SYSTEMEN PWL (PLANE WAVE LENS) - PLEXIGLAS EN TETRYL-PLEXIGLAS]

A. A. Schilperoord, J. J. Damste, and T. deJosselindeJong 20 Nov. 1975 61 p refs In DUTCH; ENGLISH summary

(Contract A70/KL/058)

(TL-1975-23; TDCK-67166) Avail: NTIS HC A04/MF A01

A method of determining the pressure distribution of a shock wave which is generated in an inert material by a detonating explosive, is described. A shadowgraph was made of the shock wave which travels through the inert medium. In the streak camera record thus obtained, a line indicates the distance covered by the shock wave in time. After measuring a number of points of this line, a function can be fitted to these points in such a way as to represent the best possible approximation of the original line in the streak record. Differentiation of this function yields the shock wave velocity as a function of the distance covered. The shock wave pressure can be computed from this. The above procedure was performed for the PWL (plane wave lens)-plexiglass and tetryl-plexiglass systems. Author (ESA)

N77-21382# Institut Franco-Allemand de Recherches, St. Louis (France).

PROGRAM FOR COMPUTING ONE-DIMENSIONAL STEADY FLOWS WITH ENERGY ADDITION IN A TUBE OF GIVEN SHAPE [PROGRAMME DE CALCUL D'ECOULEMENTS MONODIMENSIONNELS STATIONNAIRES AVEC APPORT D'ENERGIE DANS UNE CONDUITE DE FORME DONNEE]

M. Joly and B. C. Jaeggy 5 Nov. 1975 76 p refs In FRENCH

(ISL-R-130/75) Avail: NTIS HC A05/MF A01

The equations applicable to a one-dimensional flow with energy addition are transferred into canonical form and solved numerically using the Runge-Kutta method. The case of a sonic flow is examined in particular, since the righthand sides of the equations have an undetermined form or become infinity. The problem of inertial conditions as well as of thermal blocking, occurring when too much energy is added, were also investigated. The computer program used for practical application of the method is described and exemplified for some nozzle flow configurations. ESA

N77-21383# Naval Postgraduate School, Monterey, Calif.

MEASUREMENT OF INSTANTANEOUS VELOCITIES FROM A FLUIDICALLY CONTROLLED NOZZLE USING A LASER DOPPLER VELOCIMETER M.S. Thesis

Michael Kenneth Hollis Sep. 1976 88 p refs

(AD-A031874;) Avail: NTIS, HC A05/MF A01 CSCL 14/2

A laser Doppler velocimeter was used to investigate the flow field produced by an oscillating jet. Velocity measurements were made with the fluidically controlled jet in both the oscillatory and non-oscillatory modes. Mean and instantaneous surveys were made to quantify the time dependent nature of the jet. GRA

N77-21384# Naval Postgraduate School, Monterey, Calif.

TIME DEPENDENT HOLOGRAPHIC INTERFEROMETRY AND FINITE-ELEMENT ANALYSIS OF HEAT TRANSFER WITHIN A RECTANGULAR ENCLOSURE M.S. Thesis

Gerald Paul Braun Sep. 1976 196 p refs

(AD-A031815) Avail: NTIS HC A09/MF A01 CSCL 20/4

In this thesis, the finite-element method was developed to numerically analyze heat transfer by laminar natural convection within a rectangular cavity, a classical fluid flow problem. A second auxiliary case study involving Couette flow was included to test the flexibility of this analysis technique. Analyzing heat flows experimentally was also explored utilizing holographic interferometry. Specific problems encountered during this phase of research are presented with appropriate comments. GRA

N77-21385# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

HEAT ADDITION TO A SUPERSONIC FLOW Final Report, 1 Sep. 1972 - 1 Jan. 1974

William C. Burson, Jr. Oct. 1976 156 p refs

(AD-A032389; AFAPL-TR-76-57) Avail: NTIS HC A08/MF A01 CSCL 20/4

Advanced propulsion engines of the future, which may fly at Mach numbers greater than five, will depend upon the supersonic heat addition process for efficient operation. In supersonic heat addition, the gas flow remains supersonic before, during, and after the heating process. The advantages of supersonic

heat addition compared to subsonic heat addition are a lower static temperature and a lower static pressure for a given energy input. Two supersonic heat addition modes are available. One is the subsonic diffusion flame propagating into a supersonic flow where the normal or perpendicular component of the flow velocity with respect to the flame front is subsonic. The disadvantage of the subsonic diffusion flame is the relatively long combustor length resulting from the subsonic normal component of the flow velocity. The other supersonic heat addition mode is a weak detonation wave where the thermal wave or flame front is supersonic relative to the heated and unheated gas. The purpose of this effort was to experimentally investigate the weak detonation wave by simulating it in a gas flow and a water flow. GRA

N77-21386# Naval Research Lab., Washington, D. C.
ANALYSIS OF THE DISPLACEMENT FIELD FOR LOCALIZED DISTURBANCES IN A STRATIFIED FLUID WITH SHEAR
John M. Bergin 14 Oct. 1976 18 p refs
(NRL Proj. K03-11; WF11123703)
(AD-A032286; NRL-8050) Avail: NTIS HC A02/MF A01 CSCL 20/4

An initial-value problem is studied for two-dimensional density perturbations of finite amplitude in an incompressible, viscous, stratified fluid. A background shear flow is permitted. Certain characteristics of the net displacement field are demonstrated to be directly computable from the initial data. An inverse problem is studied, and it is shown how characteristics of the initial density perturbation can be deduced from knowledge of the initial and final shapes of the region containing the initial density perturbation. GRA

N77-21387# Hawaii Univ., Honolulu. Dept. of Mechanical Engineering.
COMBINED FREE AND FORCED BOUNDARY LAYER FLOWS ABOUT INCLINED SURFACES IN A POROUS MEDIUM
Ping Cheng 28 Jun. 1976 26 p refs
(Contract E(04-3)-1093; Grant NSF GI-38319)
(PB-261560/7; HGP-TR-15; NSF/RA-760374) Avail: NTIS HC A03/MF A01 CSCL 08I

The problem of combined free and forced convection about inclined surfaces (or wedges) in a porous medium is analyzed on the basis of boundary layer approximations. Similarity solutions are obtained for the special case where the free stream velocity and wall temperature distribution of the inclined surface vary according to the same power function of distance. Both aiding and opposing flows are considered. GRA

N77-21388# Naval Surface Weapons Center, White Oak, Md.
BOUNDARY-LAYER TRANSITION EXPERIMENTS ON PRE-ABLATED GRAPHITE NOSETIPS IN A HYPERBALLISTICS RANGE Final Report, Jun. 1974 - Jun. 1976
Daniel C. Reda and Robert A. Leverance 30 Jun. 1976 78 p refs
(SF32322501)
(AD-A032149; NSWC/WOL/TR-76-71) Avail: NTIS HC A05/MF A01 CSCL 16/3

An experimental program was conducted to test the validity of extrapolating the PANT (Passive Nosetip Technology) boundary-layer transition correlation, based on wind-tunnel/calorimeter-model results, to actual nosetip materials exposed to actual reentry environments. Pre-ablated ATJ-S graphite nosetips were flown on specific ballistics range trajectories through both air and nitrogen (with and without ablation). Surface temperature contours were measured via electrooptical pyrometry, from which transition zone presence and location were inferred. Significant discrepancies were noted between predicted and experimentally observed transition zone behavior, as influenced by Reynolds number and wall-temperature effects. A question was raised concerning characterization of a surface microroughness distribution, for transition purpose, by its median value. In addition, significant surface roughness effects on laminar-flow heat-transfer rates were noted. Author (GRA)

N77-21389# Spectron Development Labs., Inc., Costa Mesa, Calif.
TURBULENT BOUNDARY LAYERS ON ROUGH WALLS Interim Report
A. F. Mills and J. F. Courtney Mar. 1976 119 p refs
(Contract F44620-76-C-0011; AF Proj. 9781)
(AD-A031286; SDL-76-6044; AFOSR-76-1098TR) Avail: NTIS HC A06/MF A01 CSCL 16/2

The influence of wall roughness on the alteration of the characteristics of the turbulent boundary layer to produce increased heat transfer and skin friction during re-entry is examined. Attention is restricted to roughness heights which are small compared with the boundary layer thickness. It is shown that rough wall transfer rates can be calculated almost as reliably as for smooth walls provided that the geometry of the roughness is known. In this regard it is pointed out that models of roughness effects for use in finite-difference boundary layer calculation procedures should be in the form of drag coefficients and sub-layer Stanton numbers to be applied as 'slip' values at a characteristic roughness height; use of mixing length models of turbulent transport with nonzero wall values is shown to have serious shortcomings. The effect of heat conduction through roughness elements is demonstrated and the implications with respect to the validity of existing sub-layer Stanton number correlations are discussed. A thorough review of the pertinent literature is included with the view towards making this report a self contained treatment of the subject. GRA

N77-21390# Iowa Inst. of Hydraulic Research, Iowa City.
A REVIEW OF EXPERIMENTAL DATA OF VERTICAL TURBULENT BOUYANT JETS
Ching Jen Chen and Wolfgang Rodi Oct. 1976 86 p refs
(PB-261311/5; IIHR-193) Avail: NTIS HC A05/MF A01 CSCL 20D

Experimental data are reviewed critically of vertical turbulent buoyant jets issuing into calm neutral or stably stratified environment. Both plane and axisymmetric jets are included and the whole Froude number range from the pure jet to the pure plume is covered. Similarity and scaling laws are introduced and the experimental data are interpreted according to these laws. Measurements of the following quantities are reviewed: rate of spread, lateral profiles of velocity, temperature or species concentration, velocity, temperature or concentration along the axis of the jet, and turbulent quantities such as fluctuating velocity and temperature and turbulent shear and heat fluxes. GRA

N77-21391# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
POST CRITICAL HEAT FLUX HEAT TRANSFER TO WATER IN A VERTICAL TUBE M.S. Thesis
J. M. Kaufman and P. Griffith Jan. 1977 94 p refs
(Contract AT(49-24)-0232)
(PB-262209/0; NUREG-0164) Avail: NTIS HC A05/MF A01 CSCL 18I

A calculational model to predict the void fraction and heat transfer in inverted annular and dispersed flow film boiling was developed. The model applies to steady state upflow of low pressure, low mass velocity water in a heated vertical tube. Subcooling in the liquid was not included in REFLUX but was included in the present model. Also, a new scheme to evaluate the void fraction was developed which uses a new criterion for changing flow regimes. As a result, the prediction of temperature transients in the loss of coolant (LOCA) is improved. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N77-21392* National Aeronautics and Space Administration. Pasadena Office, Calif.
ELECTROMAGNETIC TRANSDUCER RECORDING HEAD HAVING A LAMINATED CORE SECTION AND TAPERED

GAP Patent
Norman I. Holt, inventor (to NASA) (JPL) Issued 10 Oct. 1972 6 p Filed 24 Jul. 1969 Sponsored by NASA
(NASA-Case-NPO-10711-1; US-Patent-3,697,705; US-Patent-Appl-SN-844315; US-Patent-Class-179-100.2C) Avail: US Patent Office CSCL 14B

An electromagnetic transducer head is provided which exhibits a wide band recording response characteristic, which comprises a plurality of separate magnetic head structures operating over different, overlapping frequency bands, and formed into an integral assembly. Each separate head structure of the assembly includes a magnetic core, and each core is provided with a gap. The cores are positioned adjacent one another so that the gaps are aligned to define a common gap, and the recording medium is drawn across the common gap. The common gap is tapered, with the gap width of each aligned gap section being different from its adjacent section. Separate windings are wound about the cores, each having different numbers of turns so as to cover overlapping frequency ranges.
Official Gazette of the U.S. Patent Office

N77-21393* National Aeronautics and Space Administration. Pasadena Office, Calif.
CRYOGENIC LIQUID SENSOR Patent
Wallis M. Tener, inventor (to NASA) (JPL) Issued 12 Jan. 1971 5 p Filed 3 Sep. 1968 Sponsored by NASA
(NASA-Case-NPO-10619-1; US-Patent-3,555,483; US-Patent-Appl-SN-757017; US-Patent-Class-338-25) Avail: US Patent Office CSCL 14B

A sensor unit for use in conjunction with a cryogenic vessel is provided, and it may be used to respond selectively to the presence of a liquid in a two phase gas/liquid flow, such as the overflow from a cryogenic vessel vent or cryogenic transfer tube. The sensor is used to trigger relays and solenoid operated valves, so as to shut off the supply to the vessel when the cryogenic liquid starts to overflow. The unit includes an electric resistance wire element which is wound on a porous tubular support member. The electrical resistance of the wire element decreases to provide a desired electrical control effect when the porous tubular support member becomes saturated with the cryogenic liquid. Official Gazette of the U.S. Patent Office

N77-21394 British Broadcasting Corp., Kingswood (England). Engineering Div.
FILM LIGHTING USING METAL-HALIDE LAMPS: THE EFFECT OF INTENSITY RIPPLE ASYMMETRY
E. W. Taylor Feb. 1977 17 p refs
(BBC-RD-1977/8) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

When a discharge lamp is run from an alternating supply, the intensity of light from the lamp varies between maximum and minimum values at twice the supply frequency. Analyzed are the film exposure variations which can occur, if such a light source is used for film lighting, when alternate intensity maxima differ in value. Author

N77-21395*# Beckman Instruments, Inc., Fullerton, Calif. Advanced Technology Operations.
TRACE GAS ANALYZER (TGA) PROGRAM Final Report
Feb. 1977 151 p refs
(Contract NAS9-14637)
(NASA-CR-151249; FR-2000-101) Avail: NTIS HC A08/MF A01 CSCL 14B

The design, fabrication, and test of a breadboard trace gas analyzer (TGA) is documented. The TGA is a gas chromatograph/mass spectrometer system. The gas chromatograph subsystem employs a recirculating hydrogen carrier gas. The recirculation feature minimizes the requirement for transport and storage of large volumes of carrier gas during a mission. The silver-palladium hydrogen separator which permits the removal of the carrier gas and its reuse also decreases vacuum requirements for the mass spectrometer since the mass spectrometer vacuum system need handle only the very low sample pressure, not sample plus carrier. System performance was evaluated with a representative group of compounds. Author

N77-21396*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF COMMERCIAL PYROELECTRIC DETECTORS
James B. Robertson and Roger K. Crouch Apr. 1977 17 p ref
(NASA-TM-X-74024) Avail: NTIS HC A02/MF A01 CSCL 14B

A series of commercially available pyroelectric detectors made from PVF2, LTO, SBN, and TGS were evaluated in terms of responsivity and detectivity as a function of frequency. The performance of the detectors evaluated was very different, depending upon the manufacturer of the detector, and this dependency was primarily related to the thickness of the various detectors. The best detectors of each material were comparable in performance at frequencies around 10 Hz but differed radically at frequencies above 100 Hz. Author

N77-21397*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
RESEARCH INSTRUMENTATION FOR TORNADO ELECTROMAGNETICS EMISSIONS DETECTION Final Technical Summary Report, Feb. 1975 - Jan. 1977
H. H. Jenkins and C. S. Wilson Jan. 1977 62 p refs
(Contract NAS5-20956)
(NASA-CR-152472) Avail: NTIS HC A04/MF A01 CSCL 14B

Instrumentation for receiving, processing, and recording HF/VHF electromagnetic emissions from severe weather activity is described. Both airborne and ground-based instrumentation units are described on system and subsystem levels. Design considerations, design decisions, and the rationale behind the decisions are given. Performance characteristics are summarized and recommendations for improvements are given. The objectives, procedures, and test results of the following are presented: (1) airborne flight test in the Midwest U.S.A. (Spring 1975) and at the Kennedy Space Center, Florida (Summer 1975); (2) ground-based data collected in North Georgia (Summer/Fall 1975); and (3) airborne flight test in the Midwest (late Spring 1976) and at the Kennedy Space Center, Florida (Summer 1976). The Midwest tests concentrated on severe weather with tornadic activity; the Florida and Georgia tests monitored air mass convective thunderstorm characteristics. Supporting ground truth data from weather radars and sferics DF nets are described.
Author

N77-21398*# Kanner (Leo) Associates, Redwood City, Calif.
HIGH PRECISION GRATINGS PRODUCED HOLOGRAPHICALLY BY MEANS OF RECONSTRUCTED IDENTICAL WAVE FRONTS
G. Schmahl and D. Rudolph Washington NASA Apr. 1977 7 p ref Transl. into ENGLISH from Optik (Stuttgart), v. 30, no. 6, 1970 p 606-609
(Contract NASw-2790)
(NASA-TT-F-16773) Avail: NTIS HC A02/MF A01 CSCL 14E

The accuracy of gratings produced according to the holographic method described was practically independent of the quality of the optical elements used. Author

N77-21399*# Kanner (Leo) Associates, Redwood City, Calif.
A SCHLIEREN PHOTOGRAPHY PROCESS FOR VISUALIZING AND DISTINGUISHING DENSITY GRADIENTS IN ANY DIRECTION
B. Becker Washington NASA Apr. 1977 8 p refs Transl. into ENGLISH of report V 144-7, Archiv fuer Technisches Messen, Feb. 1972 p 21-22
(Contract NASw-2790)
(NASA-TT-F-17431) Avail: NTIS HC A02/MF A01 CSCL 14E

A new schlieren photography method is discussed in comparison with conventional methods, and the advantages of the new method are pointed out in terms of greater sensitivity and specificity. Author

N77-21400*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALIBRATION OF A UNIVERSAL INDICATED TURBULENCE SYSTEM
William G. Chapin 8 Mar. 1977 37 p refs

(NASA-TM-X-74023) Avail: NTIS HC A03/MF A01 CSCL 14B

Theoretical and experimental work on a Universal Indicated Turbulence Meter is described. A mathematical transfer function from turbulence input to output indication was developed. A random ergodic process and a Gaussian turbulence distribution were assumed. A calibration technique based on this transfer function was developed. The computer contains a variable gain amplifier to make the system output independent of average velocity. The range over which this independence holds was determined. An optimum dynamic response was obtained for the tubulation between the system pitot tube and pressure transducer by making dynamic response measurements for orifices of various lengths and diameters at the source end. Author

N77-21401*# Southeastern Scientific Co., Inc., Knoxville, Tenn.
EVALUATION OF NASA SPEECH ENCODER Final Report
15 Dec. 1976 79 p refs
(Contract NAS5-23460)
(NASA-CR-152477) Avail: NTIS HC A05/MF A01 CSCL 14B

Techniques developed by NASA for spaceflight instrumentation were used in the design of a quantizer for speech-decoding. Computer simulation of the actions of the quantizer was tested with synthesized and real speech signals. Results were evaluated by a phonetician. Topics discussed include the relationship between the number of quantizer levels and the required sampling rate; reconstruction of signals; digital filtering; speech recording, sampling, and storage, and processing results. Author

N77-21402*# Ball Bros. Research Corp., Boulder, Colo.
SOLAR EUV SPECTROPHOTOMETER FOR ATMOSPHERE EXPLORER SATELLITES Final Report, Oct. 1971 - Jun. 1976
Jay L. Buckley 31 Aug. 1976 40 p refs
(NASA Order S-50030-AG; Contract F19628-72-C-0115)
(NASA-CR-149345; AD-A032386; AFGL-TR-76-0202) Avail: NTIS HC A03/MF A01 CSCL 14/2

Development of the Extreme Ultraviolet Spectrophotometers (EUVS) for the NASA Atmosphere Explorer (AE) mission began October 1971. The Protoflight EUVS was successfully launched December 1973. Flight Units were successfully launched October and November 1974. Technical description and Program history is presented herein. Author (GRA)

N77-21403*# Analog Technology Corp., Pasadena, Calif.
DESIGN AND FABRICATION OF A BASIC MASS ANALYZER AND VACUUM SYSTEM Final Report
Charles M. Judson, Conrad Josias, and James L. Lawrence, Jr. Washington NASA Apr. 1977 67 p
(Contract NAS1-13843)
(NASA-CR-2815) Avail: NTIS HC A04/MF A01 CSCL 14B

A two-inch hyperbolic rod quadrupole mass analyzer with a mass range of 400 to 200 amu and a sensitivity exceeding 100 packs per billion has been developed and tested. This analyzer is the basic hardware portion of a microprocessor-controlled quadrupole mass spectrometer for a Gas Analysis and Detection System (GADS). The development and testing of the hyperbolic-rod quadrupole mass spectrometer and associated hardware are described in detail. Author

N77-21404*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PERFORMANCE EVALUATION OF A QUASI-MICROSCOPE FOR PLANETARY LANDERS
Ernest E. Burcher, Friedrich O. Huck, Stephen D. Wall, and Susan B. Woehrle (Washington Univ., St. Louis, Mo.) Washington Mar. 1977 25 p refs Original contains color illustrations
(NASA-TN-D-8370; L-11162) Avail: NTIS HC A02/MF A01 CSCL 14B

Spatial resolutions achieved with cameras on lunar and planetary landers have been limited to about 1 mm, whereas microscopes of the type proposed for such landers could have obtained resolutions of about 1 um but were never accepted because of their complexity and weight. The quasi-microscope evaluated in this paper could provide intermediate resolutions of about 10 um with relatively simple optics that would augment a camera, such as the Viking lander camera, without imposing special design requirements on the camera of limiting its field of view of the terrain. Images of natural particulate samples taken in black and white and in color show that grain size, shape, and texture are made visible for unconsolidated materials in a 50- to 500-um size range. Such information may provide broad outlines of planetary surface mineralogy and allow inferences to be made of grain origin and evolution. The mineralogical descriptions of single grains would be aided by the reflectance spectra that could, for example, be estimated from the six-channel multispectral data of the Viking lander camera. Author

N77-21405# Sandia Labs., Albuquerque, N.Mex.
STOP-MOTION RADIOGRAPHY
R. W. Mottern 1976 37 p refs Presented at Am. Soc. for Nondestructive Testing Flash X-ray Symp., Houston, Tex., 27 Sep. 1976
(Contract E(29-1)-789)
(SAND-76-5614; Conf-760914-8) Avail: NTIS HC A03/MF A01

A variety of radiographic techniques to examine dynamic events are described. The techniques, while not interfering with the events, make possible recording of data not obtainable by other means. The events being recorded may occur within microseconds or may require a time span of many seconds. Arrangement of equipment and various methods of image recording are discussed. ERA

N77-21406# California Univ., Berkeley. Lawrence Berkeley Lab.
THIN-FILM dc SQUID GRADIOMETER
G. B. Donaldson, M. B. Ketchen, W. M. Goubeau, and J. Clarke Aug. 1976 4 p refs Presented at Appl. Superconductivity Conf., Stanford, Calif., 17 Aug. 1976
(Contract W-7405-eng-48)
(LBL-5462; Conf-760829-32) Avail: NTIS HC A02/MF A01

A thin film dc SQUID gradiometer has been fabricated on a single planar substrate. The superconducting pick-up loops consist of a lead strip in the form of a 48 x 16 mm rectangle with a niobium strip bisecting the rectangle. A tunnel junction dc SQUID is symmetrically located on the niobium strip. If there is a spatial gradient in the magnetic field applied to the gradiometer so that the magnetic fluxes threading the two pick-up loops differ, a supercurrent is induced in the niobium strip that is detected by the SQUID. The noise power spectrum of the SQUID is white down to a frequency of about 5 x 0.01 Hz with a rms flux noise of 8 x 0.00001 phi sub Hz/sup1/2/, corresponding to a gradient sensitivity of 2 x 0.000001 G cm/1 Hz/sup- 1/2/. ERA

N77-21407# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. Development Div.
OPTOELECTRONIC TIMING SYSTEM Technical Report, Apr. - Jun. 1976
Larry D. Hanes 1976 10 p refs Sponsored in part by ERDA
(Contract DA-11-173-AMC-487(A))
(MHSMP-76-30N) Avail: NTIS HC A02/MF A01

An optoelectronic timing system being developed for the measurement of detonation front arrival times in an initiation sensitivity test is described. Emphasis is given to the design, construction, and testing of a photodiode circuit a two-nanosecond rise time response proportional to light intensity and an adequate voltage output for the level of light intensity encountered in the sensitivity test. ERA

N77-21408# California Univ., Livermore. Lawrence Livermore Lab.
DIRECT READOUT DEVICES FOR STREAK CAMERAS
J. C. Cheng, S. W. Thomas, E. K. Storm, W. R. McLerran, G. R. Tripp, and L. W. Coleman 16 Aug. 1976 7 p refs Presented at the 12th Intern. Congr. on High Speed Photography, Toronto, 1-7 Aug. 1976
(Contract W-7405-eng-48)
(UCRL-77746; Conf-760828-11) Avail: NTIS HC A02/MF A01

Two techniques are used to obtain a direct readout of an ultrafast streak camera. The first method uses a linear solid state diode array and the second technique entails the use of a vidicon camera. Both methods use fiber optics to couple the

light from the output of the streak camera to the sensor. In addition, the vidicon is interfaced to a PDP 11/40 graphics computer system for direct data processing. For both systems, data is presented as to (1) dynamic range, (2) spatial resolution, (3) linearity, (4) signal processing techniques, and (5) problems and modifications of the devices including mechanical mounting procedure for attaching fiber optics directly to the array chip.
ERA

N77-21409# California Univ., Livermore. Lawrence Livermore Lab.
FIBER ARRAY TECHNIQUE FOR SUBNANOSECOND X-RAY FRAMING CAMERA
J. C. Cheng 16 Aug. 1976 7 p refs Presented at 12th Intern. Congr. on High Speed Phot., Toronto, 1-7 Aug. 1976
(Contract W-7405-eng-48)
(UCRL-77740; Conf-760828-10) Avail: NTIS HC A02/MF A01

A subnanosecond X-ray framing camera technique employing a fiber optics image dissector coupled to a 10 ps optical streak camera is described. The output data from the streak camera can be reduced from photographic film or directly coupled into a SEC Vidicon camera for immediate computer decoding of each scan line into a two dimensional picture. The use of the new subnanosecond plastic scintillator in front of the fiber optics dissector is also discussed. The description of the basic principle, fiber optic's image dissector construction, time resolution considerations, and experimental data on a prototype 7 by 7 array are included.
ERA

N77-21410# Centre National d'Etudes Spatiales, Toulouse (France).
SELECTION OF A DOPPLER RECEIVER DESIGN [CHOIX D'UN SCHEMA DE RECEPTEUR DOPPLER]
Alain Blanchard Jul. 1976 109 p In FRENCH; ENGLISH summary
(CNES-NT-42) Avail: NTIS HC A06/MF A01

An analysis is presented of selections to be made during the preliminary design of a coherent receiver which has to perform a very accurate two-way Doppler effect measurement. Some practical and technological considerations along with the phase noise performances of the various oscillators involved (frequency standard, transponder and receiver VCXO) lead to the indirect (or heterodyne) phase-locked loop as the basic receiver structure. This structure is attractive when considering the phase-locked loop threshold as well as the Doppler measurement accuracy. It is also shown that the two Doppler measurement methods - frequency counter used as a frequency-meter or as a period-meter are theoretically equivalent, but the period-meter method is generally preferred from a technological point of view.
Author (ESA)

N77-21411# National Aerospace Lab., Amsterdam (Netherlands). Space Flight Div.
INVESTIGATION OF A CROSS-COUPLING DRIFT COMPENSATION METHOD ON A SINGLE AXIS GYRO STABILIZED PLATFORM
J. A. Bosgra, A. J. Mooy, and H. Smilde 14 Jan. 1976 58 p refs
(NLR-TR-76039-U) Avail: NTIS HC A04/MF A01

The rectification drift phenomenon in a semi-strapdown system mechanized as a single axis platform (SAP), and a method to compensate for it, were investigated both theoretically and experimentally. In a hardware test setup, using an experimental SAP composed of surplus parts from the former ELDO-A program, the theoretical result as well as a proposed method of compensation was verified.
Author (ESA)

N77-21412# Physics Lab. RVO-TNO, The Hague (Netherlands).
AN OPTICAL VELOCITY MEASUREMENT SYSTEM FOR PROJECTILES (PHOTOBEAM SYSTEM 3)
A. W. M. vanderVoort Apr. 1976 76 p In DUTCH; ENGLISH summary
(Contract A73/KM/079)
(PhL-1976-18; TDCK-67794) Avail: NTIS HC A05/MF A01

An apparatus, for initial velocity measurements of projectiles is described. The equipment consists of an optical detection system and a time measuring unit. The optical detection system is a tube with two photocell detectors, one mounted at each end. The distance between the photocell detectors is 2 meters. The photocell detectors have fanshaped fields, with a viewing angle of 336 mil, which are placed perpendicularly on the axis of the tube. The axis of the optical detection system is placed parallel to the projectile trajectory. When a projectile passes the field of view of one of the photocell detectors, the skylight falling on the photodiode decreases. The photodiode transforms the light decrease into an electrical signal. The time measuring unit eliminates most of the erratic signals and accepts the correct ones. An accepted signal is transformed into pulses, corresponding in time with the passing of the front or the back of the projectile through the field of view. The time interval between the front and the back of the two photodiode signals is measured with electronic counters.
Author (ESA)

N77-21413# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.
APPLICATION OF ELECTRONIC IMAGING TECHNIQUES Three-Year Report, Dec. 1970 - Dec. 1973 [TOEPASSING ELEKTRONISCHE BEELDTECHNIEKEN. VERSLAG OVER DE PERIODE DECEMBER 1970 - DECEMBER 1973]
P. J. F. Geerders, J. Polstra, and A. H. M. Weerdesteyn Oct. 1974 79 p refs In DUTCH; ENGLISH summary
(NIWARS-Publ-19) Avail: NTIS HC A05/MF A01

The application of black and white to color image transformation as an aid to remote sensing photo interpretation was studied. The human visual system is dealt with and some image transformation techniques such as photographic, optical, and electronic image transformation are described. The realized system, consisting of a TV-camera, a video recorder, a density corrector, a contour adder, a pseudo relief apparatus, a black and white to color transformer, and three monitors, is described and some test results are discussed.
ESA

N77-21414# Institut Franco-Allemand de Recherches, St. Louis (France).
HOLOGRAPHIC INTERFEROMETRY STUDY OF BIREFRINGENT MATERIAL DEFORMATIONS CAUSED BY PROJECTILE IMPACT Final Report [ETUDE, PAR INTERFEROMETRIE HOLOGRAPHIQUE, DES DEFORMATIONS D'UN MATERIAU BIREFRINGENT SOUS L'IMPACT D'UN PROJECTILE]
F. Albe, H. Fagot, and P. Smigielski 12 May 1976 41 p refs In FRENCH
(Contract DRME-75/34.057)
(ISL-R-112/76) Avail: NTIS HC A03/MF A01

The dynamic deformation of white sapphire disks was investigated using several holographic setups and double exposures. The material may be used as transparent armor. The deformations produced by the impact of steel or lead projectiles vary according to the position of the crystal plane in respect to the optical axis. The effect of sapphire birefringence on the deformations is not large enough to be detected uniquely by the shapes of the interference fringes, which are the lines of equal deformation amplitude.
ESA

N77-21415# Tri-Con Associates, Inc., Cambridge, Mass.
ELECTRONIC SUBSYSTEM FOR NORMAL INCIDENCE ULTRAVIOLET SPECTROMETER Final Report, 1 Sep. 1973 - 30 Jun. 1976
Robert S. Hills Hanscom AFB, Mass. AFGL 1 Sep. 1976 35 p
(Contract F19628-74-C-0001)
(AD-A031499; C-129; AFGL-TR-76-0206) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report describes the design, fabrication and launch of an electronics subsystem for a normal incidence ultraviolet grating spectrometer for sounding rockets. It also describes an electronics subsystem built for an electron spectrometer which was launched as an auxiliary experiment carried by the grating spectrometer.
Author (GRA)

N77-21416# Oakland Univ., Rochester, Mich.
NEW OPTICAL METHOD TO DETERMINE VIBRATION-INDUCED STRAINS WITH VARIABLE SENSITIVITY AFTER RECORDING
Y. Y. Hung, J. D. Hovanesian, and A. J. Durelli Nov. 1976

32 p refs
(Contract N00014-76-C-0487; Grant NSF ENG-76-08751)
(AD-A032087; Rept-41) Avail: NTIS HC A03/MF A01 CSCL 20/11

A steady-state vibrating object is illuminated with coherent light and its image is slightly misfocused in the film plane of a camera. The resulting processed film is called a 'Time-integrated specklegram'. When the specklegram is Fourier filtered, it exhibits fringes depicting derivatives of the vibrational amplitude. The direction of the spatial derivative, as well as the fringe sensitivity may be easily and continuously varied during Fourier filtering process. Besides the above mentioned advantages, this new method is also much less demanding than holographic interferometry with respect to vibration isolation, optical set-up time, illuminating source coherence, required film resolution, etc. Author (GRA)

N77-21417# Air Force Geophysics Lab., Hanscom AFB, Mass.
CRYOGENIC, WHOLE-AIR SAMPLER AND PROGRAM FOR STRATOSPHERIC COMPOSITION STUDIES Environmental Research Papers.
Charles C. Gallagher and Robert V. Pieri 20 Jul. 1976 21 p refs
(AD-A032384; AFGL-TR-76-0161; AFGL-ERP-574) Avail: NTIS HC A02/MF A01 CSCL 14/2

A program has been initiated to measure the stratospheric content of NO, NO2, CO, SO2, CH4, NH3 and other trace gases which may influence our environment. The initial or baseline concentrations of these gases are being measured as a function of altitude and latitude. Subsequent measurements will indicate any time dependency in these concentrations and permit a possible correlation with increased Air Force stratospheric operations. Latitudes from Panama to Alaska and altitudes from 12 to 30 km will be investigated. Author (GRA)

N77-21418# Naval Postgraduate School, Monterey, Calif.
OPTICAL TRANSMISSOMETER-NEPHELOMETER FOR DEEP OCEAN USE M.S. Thesis
David Michael Mosey Sep. 1976 79 p refs
(AD-A032371) Avail: NTIS HC A05/MF A01 CSCL 20/6

A submersible light transmissometer-nephelometer was designed and constructed for the purpose of measuring the beam attenuation and relative volume scattering coefficients at two fixed angles and at depths to 1,000 meters. Flexibility, a major design criterion, makes it possible for the unit to be operated in a number of configurations. Addition of an internal battery supply, a filter wheel, light stops, a photomultiplier tube and amplifiers is possible. The NPS light transmissometer-nephelometer is not a single purpose instrument but has the capability to be utilized as a submersible optical bench, useful in the development of underwater optical instrumentation. Author (GRA)

N77-21419# Air Force Avionics Lab., Wright-Patterson AFB, Ohio. Reconnaissance and Weapon Delivery Div.
PRACTICAL CONSIDERATIONS IN GRANULARITY MEASUREMENTS Final Report, Dec. 1974 - Apr. 1975
Edward L. Gliatti and Bruce A. Kress Mar. 1976 31 p refs (AF Proj. 2004)
(AD-A031303; AFAL-TR-75-102) Avail: NTIS HC A03/MF A01 CSCL 14/5

RMS granularity measurement techniques and problems are examined using Kodak 3414 film as the test specimen. The flashed wedges with pelloids on the film backing increased the RMS granularity as compared to an equivalently exposed 3414 film with pelloids removed. Proper microdensitometer focus is important for obtaining the best density versus position trace data, and thus, the best RMS granularity figure. Computer routines to eliminate density wedging due to nonuniform exposure and spikes caused by scratches or foreign particles improved the reliability of the RMS granularity calculation. The probability density distribution of the density data for a flashed specimen with pelloids removed is very near a Gaussian density distribution after data imperfections are removed. Author (GRA)

N77-21420# Michigan State Univ., East Lansing. Div. of Engineering Research.
PRELIMINARY DEVELOPMENT OF AN INTERFEROMETRIC STRAIN GAGE FOR USE ON NOSETIP MATERIALS SUBJECTED TO THERMAL SHOCK Final Technical Report, 1 May 1975 - 31 Mar. 1976
W. N. Sharpe, Jr. Jun. 1976 72 p refs
(Contract F33615-75-C-5230; AF Proj. 627A)
(AD-A031320; AFML-TR-76-63) Avail: NTIS HC A04/MF A01 CSCL 14/2

This report describes the results of a limited effort to extend the capabilities of the interferometric strain gage (ISG) to high temperatures at high heating rates on graphite and tungsten. The specified temperature limit was 2500 F, which was to be reached in a time of approximately two seconds. Experiments were conducted using a specially constructed furnace at Michigan State University to evaluate various facets of the technique, and the high heating rate experiments were conducted at Southern Research Institute. The ISG is based on the motion of laser-generated interference patterns from the specimen surface. If suitable reflecting surfaces can be made that will withstand the high temperature environment, then the technique has great potential. Details of the techniques and instrumentation, as well as descriptions of the various evaluative experiments, are included in this report. GRA

N77-21421# Northeastern Univ., Boston, Mass.
INSTRUMENTATION SYSTEMS FOR MASS SPECTROMETERS Final Report, 1 Sep. 1973 - 31 Jul. 1976
J. Spencer Rochefort and Raimundas Sukys 1 Sep. 1976 44 p refs
(Contract F19628-74-C-0042)
(AD-A032313; AFGL-TR-76-0200) Avail: NTIS HC A03/MF A01 CSCL 14/2

Two rectangular waveform generators to excite the rods of quadrupole mass spectrometers are described. One of the units may be operated between one and two MHz with an output voltage ranging from 4 to 80 volts. The rise and fall times are less than 50 ns. The other unit operates at one MHz over a 4 to 200 volt range with the rise and the fall times of 30 ns while driving a 30 pF load. Also included in the report are summaries of previously reported work: circuits to control a thermal emission unit used in an experiment to control vehicle potential; bias circuits for a mass spectrometer in the project EXCEDE (SWIR experiment); and modifications performed on existing mass spectrometers intended for the studies of the upper atmosphere. Author (GRA)

N77-21118*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A K-BAND RADIOMETER FOR THE MICROWAVE WEATHER PROJECT
K. Wallace, M. Reid, and H. Reilly *In its* The Deep Space Network 15 Apr. 1977 p 66-69 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N77-21422*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IS THERE A MASER IN THE SILICON MONOXIDE GROUND STATE Final Report
David Buhl, Lewis E. Snyder (Va. Univ., Charlottesville), Frank J. Lovas (NBS), and Donald R. Johnson (NBS) 8 May 1975 5 p refs Repr. from Astrophys. J., Vol. 201, 1 Oct. 1975 p 129-131
(Grant NSF GP-3420)
(NASA-TM-X-74630; PB-258972/9) Avail: NTIS HC A02/MF A01 CSCL 03B

Observations of the ground state (v=0, j=2-1) transition of silicon monoxide (SiO) shows a rather smooth, low intensity profile stretching over a large velocity range. The presence of ground state emission at velocities which are not present is the v=1 or v=2 lines is interpreted as thermal emission in the ground state in regions where there is insufficient excitation to produce the vibrationally excited masers. Only VY Canis Majoris shows a profile which could be interpreted as ground-state maser emission. GRA

N77-21423# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
FREQUENCY STABILIZATION OF HF LASERS BY MEANS OF BEAT SIGNALS AND ANOMALOUS DISPERSION
C. P. Wang and R. L. Varwig 15 Mar. 1977 21 p refs
(ATR-77(8204)-1) Avail: NTIS HC A02/MF A01

A HF chemical laser was frequency-stabilized by a scheme in which beat signals between adjacent longitudinal modes and the anomalous dispersion of the gain medium were used. The basic theory and the feedback loop are described. An absolute frequency stability of 1 MHz and a relative frequency stability of 50 KHz were achieved. Author

N77-21424*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VOLUMETRIC DIRECT NUCLEAR PUMPED LASER Patent Application
Nelson W. Jalufka, Frank Hohl, Russell J. DeYoung (Vanderbilt Univ.), and Michael D. Williams, inventors (to NASA) Filed 19 Apr. 1977 12 p
(NASA-Case-LAR-12183-1; US-Patent Appl-SN788704) Avail: NTIS HC A02/MF A01 CSCL 20E

A volumetric direct nuclear pumped laser was developed in which the gas is a mixture of 3He and a minority gas from the group of argon, krypton, xenon, chlorine, nd fluorine. The mixture of 3He and the minority gas produces lasing with a minority gas concentration of from 0.01 to 10 percent argon, 1 percent krypton, 0.01 to 5 percent xenon and small concentrations of chlorine or fluorine. Author

N77-21425# California Univ., Livermore. Lawrence Livermore Lab.
LASERS FOR THERMONUCLEAR FUSION AND THEIR PROPERTIES
W. F. Krupke and E. V. George Aug. 1976 31 p refs Presented at 20th Ann. SPIE Tech. Symp., San Diego, Calif., 23 Aug. 1976
(Contract W-7405-eng-48)
(UCRL-78566; Conf-760832-15) Avail: NTIS HC A03/MF A01

Laser system requirements for fusion applications are presented. A comparison between the photolytic atomic iodine and electron beam pumped rare gas oxide laser systems are made in the context of a fusion laser system. The use of spontaneous and superfluorescent emission from selected rare gas halogen exciplex systems to pump high average power atomic iodine lasers is explored with emphasis on the pump source kinetics in relation to amplifier design. ERA

N77-21426# California Univ., Livermore. Lawrence Livermore Lab.
DESIGN TECHNIQUES AND MEASURED PERFORMANCE FOR A UNIFORMLY-PUMPED 4-cm DIAMETER ROD AMPLIFIER
G. J. Linford and S. M. Yarema 30 Jun. 1976 26 p refs Presented at 22d Intern. Instrumentation of the Instrument Soc. of Am., San Diego, Calif., 25 May 1976
(Contract W-7405-eng-48)
(UCRL-78579; Conf-760513-11) Avail: NTIS HC A03/MF A01

A solid-state laser rod amplifier of moderate aperture achieving a high degree of spatial gain uniformity has been constructed and its performance evaluated. Digital and analogue techniques were used to optimize the amplifier design for performance in a laser fusion application. Results of simple 2-D computer simulations and experimental evaluations of amplifier performance are presented. ERA

N77-21427# California Univ., Livermore. Lawrence Livermore Lab.
LASERS FOR ISOTOPE SEPARATION PROCESSES AND THEIR PROPERTIES
E. V. George and W. F. Krupke Aug. 1976 8 p refs Presented at 20th Ann. SPIE Technical Symp., San Diego, Calif., 23 Aug. 1976
(Contract W-7405-eng-48)
(UCRL-78549; Conf-760832-20) Avail: NTIS HC A02/MF A01

The laser system requirements for isotope enrichment are presented in the context of an atomic uranium vapor process. Coherently pumped dye lasers using as the pump laser either the frequency doubled Nd:YAG or copper vapor are seen to be quite promising for meeting the near term requirements of a laser isotope separation (LIS) process. The utility of electrical discharge excitation of the rare gas halogens in an LIS context is discussed. ERA

N77-21428# Bendix Corp., Kansas City, Mo.
LASER CONTOURED AND DRILLED SUBSTRATES FOR THICK FILM APPLICATIONS Final Report
F. Uribe Sep. 1976 20 p Revised
(Contract E(29-1)-613)
(BDX-613-1563-Rev) Avail: NTIS HC A02/MF A01

The feasibility of using laser contoured and drilled substrates for thick film circuits was demonstrated. Laser contouring and drilling was found to provide the dimensional accuracy required, and the finished product was proven capable of withstanding the thermal stresses imposed by thermal shock tests conducted. ERA

N77-21429# Princeton Univ., N.J. Plasma Physics Lab.
RATE EQUATION MODEL OF A HYBRID CW-TEA CO2 LASER
B. Walkup Oct. 1976 24 p refs
(Contract E(11-1)-3073)
(PPPL-1295) Avail: NTIS HC A02/MF A01

A theoretical model of a hybrid CW-TEA CO2 laser is presented which, in agreement with preliminary experiments, predicts single mode performance of the hybrid laser system when the CW section is maintained above threshold. Such a single mode laser pulse is required for proposed coherent laser scattering plasma diagnostics. ERA

N77-21430# Institut Franco-Allemand de Recherches, St. Louis (France).
THE EXCITATION OF HIGH PRESSURE MOLECULAR GASES BY ELECTRON INJECTION [UNTERSUCHUNGEN UEBER DIE ANREGUNG VON MOLEKUELGASEN HOHEN DRUCKES DURCH ELEKTRONENINJEKTION]
M. Hugenschmidt and K. Vollrath 11 Sep. 1975 23 p refs In GERMAN
(Contract T/RF-31/RF-310/51140)
(ISL-R-125/75) Avail: NTIS HC A02/MF A01

The development of a TEA laser preionized by an electron beam is reported. Parametric investigations were carried out on the beam source, the electron current, the pulse half width as function of the window thickness, and the laser itself (working gas, pressure, resonator, energy storage circuit). An essential parameter is discharge stability, which was investigated optically and by holographic interferometry. Current-voltage measurements were carried out to determine electron densities. The active mode volume of the laser was adapted by using a plane mirror causing the beam to follow a broken path. Pulse energies, of 4 to 8 microsec duration, of 20 J were obtained. ESA

N77-21431# Institut Franco-Allemand de Recherches, St. Louis (France).
LASER DYNAMICS AND ROTATIONAL RELAXATION IN CHEMICALLY FORMED CARBON MONOXIDE, PART 1
K. Daree 22 Jul. 1976 15 p refs
(ISL-R-119/76) Avail: NTIS HC A02/MF A01

Pulsed laser action from gaseous mixtures of CS2:O2 was investigated. Numerical calculations of the pulse shapes (intensities) were carried out for a large number of vibrational-rotational transistions and compared with experiments for some examples. The computations show that rotational relaxation determines to a wide extent the spectral and temporal output of the laser. Author (ESA)

N77-21432# Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
EVALUATION OF THE VISUAL SIGNALLER DEVELOPED FOR THE 82D AIRBORNE DIVISION, SEPTEMBER-OCTOBER 1976
Terry L. Lyon 18 Nov. 1976 7 p refs
(AD-A032257; USAEHA-42-0307-77) Avail: NTIS

HC A02/MF A01 CSCL 06/18

A laser radiation protection special of the visual signallers constructed for the 82d Airborne Division by Harry Diamond Laboratories was conducted by this Agency on 16 September 1976. Radiometric measurements indicated that these signallers are Class II helium-neon laser products and therefore do not pose a momentary viewing hazard. Author (GRA)

N77-21433# North Texas State Univ., Denton. Dept. of Physics.

LASER OPTICAL BIASING OF THE QUANTUM TRANSPORT PROPERTIES OF N-InSb Annual Summary Report, 1 Oct. 1975 - 30 Sep. 1976

David G. Seiler Oct. 1976 22 p refs

(Contract N00014-76-C-0319)

(AD-A032069) Avail: NTIS HC A02/MF A01 CSCL 20/12

We report here the first experimental attempt to measure the mean energy of photoexcited carriers in n-InSb using the Shubnikov de Haas (SdH) effect as a temperature probe. Preliminary measurements with a mechanically chopped CO2 laser beam have shown that the laser radiation changes the amplitude of the SdH oscillations. The research being done is directed at obtaining fundamental information concerning the effects of CO and CO2 laser radiation on the quantum transport properties on n-InSb. Author (GRA)

N77-21434# Hughes Research Labs., Malibu, Calif.

OPTIMIZED THIN FILM LIGHT SOURCES Final Technical Report, 2 Jan. 1975 - 2 Jan. 1976

Robert G. Hunsperger and Amnon Yariv Sep. 1976 70 p refs

(Contract F33615-75-C-1024)

(AD-A032264; AFAL-TR-76-8123) Avail: NTIS HC A04/MF A01 CSCL 20/5

The objective of this program was to develop and demonstrate techniques for efficiently coupling a semiconductor injection laser source to a hybrid optical integrated circuit. The specific design objectives were to produce and deliver two hybrid coupled laser/waveguide sources in which the laser was operated at 300 rk, driven with 20 to 250 nls length pulses at a repetition rate up to 104 P.P.S, emitting light at a wavelength between 0.8 micrometers into a thin film planar waveguide or either Ta205 or Nb205. At least one watt of peak optical power was to be coupled into the lowest order waveguide mode with a coupling efficiency of greater than 10%. All of the stated program objectives were achieved and in some cases surpassed. The approach used was to couple commercially available (GaAl) as laser diodes to thin film planar waveguides in a direct end-butt coupling arrangement. GRA

N77-21435# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

LASER CAVITY OPTICS Final Report, 1 Oct. 1974 - 30 Jun. 1976

Martin Barberio, Jr. 26 Aug. 1976 24 p

(Contract N00014-74-C-0427)

(AD-A032107; FR-7881) Avail: NTIS HC A02/MF A01 CSCL 20/6

This program consisted of a cooperative effort between Pratt and Whitney Aircraft/Florida and United Technologies Research Center (UTRC). The purpose of this effort was to provide a DF wavelength chemical laser beam from a stable resonator for a materials evaluation program conducted by Naval Research Laboratory (NRL) personnel. P and WA/Florida was responsible for providing the device operating conditions and the stable resonator optical system while UTRC was responsible for operation of the test facility and directing of the beam to the target from downstream of the material window. This final report covers work completed under the P and WA/Florida contract only. The P and WA/Florida contract was divided into 5 Tasks: During Task I, an analysis was performed to determine the best operating conditions for the Contractor furnished chemical laser device to achieve outcoupling of the laser beam to the target area. Task II covered the design of a cooled outcoupling mirror and redesign of the contractor furnished chemical laser optical system to allow transmission of the laser beam exterior to the device through a material window. Task III covered fabrication of all parts and flow testing of the outcoupling mirror. Task IV consisted of P and WA/Florida engineering follow-up during set-up and testing of the chemical laser device at UTRC. Task V covered the work required for submittal of all reports generated during this program. GRA

N77-21436# Lincoln Lab., Mass. Inst. of Tech., Lexington.

REPETITIVELY PULSED CO2 LASER-TARGET INTERACTION

Scott K. Manlief, Daniel L. Mooney, and Stephen Marcus 30 Aug. 1976 31 p refs

(Contract F19628-76-C-0002; ARPA Order 600)

(AD-A031810; LTP-34; ESD-TR-76-248) Avail: NTIS HC A03/MF A01 CSCL 20/5

Thermal coupling of CO2 laser energy to metal surfaces of aluminum, titanium, stainless steel and copper has been measured under large-spot, repetitively pulsed conditions using the AVCO Humdinger, Sr., laser. Measurements were made at atmospheric pressure with a Mach 0.4 air flow transverse to the target surface and in a low-pressure environment of approx. 3 torr. The multipulse coupling measured with Humdinger, Sr., is consistently less than previous measurements of single-pulse and small-spot multipulse coupling measured at other laser facilities. Time-resolved measurements of the energy deposition indicate that the differences in the various sets of coupling data may be due to pulse shape effects. Author (GRA)

N77-21437# Naval Postgraduate School, Monterey, Calif.

METAL ATOM OXIDATION LASER M.S. Thesis

Richard C. Feierabend Sep. 1976 105 p refs

(AD-A031820) Avail: NTIS HC A06/MF A01 CSCL 20/5

This work represents a continuation of research investigating the feasibility of a metal atom oxidation laser. The work was done on a metal-atom oxidation laser set-up which was designed and constructed as part of previous thesis research. The series of experiments was conducted with ten rare earth elements in a pure oxygen environment. A brief discussion of the toxicity and handling characteristics of the rare earth elements, the metal oxide laser system, and the possible metal deposition techniques is presented. The technique finally used in the metal deposition process and the difficulties incurred with this technique are also discussed. Although no positive lasing action was noted, results from these experiments suggest further investigation is warranted. GRA

N77-21438# Naval Postgraduate School, Monterey, Calif.

GASDYNAMIC EFFECTS ON AN ELECTRIC DISCHARGE IN AIR M.S. Thesis

Jonney Lynn Barto Sep. 1976 147 p refs

(AD-A032301) Avail: NTIS HC A07/MF A01 CSCL 20/5

The overall purpose of this work is to develop a subsonic, turbulent, diffuse electric discharge operating at near atmospheric pressure for use as the pumping mechanism in an Electric Discharge Convection Laser (EDCL). The work was done in two phases. The first consisted of a data collection phase during which the variation of discharge parameters was studied to determine their effects on the current-voltage characteristics of the multi-pin electrode arrangements used. The parameters studied included gap length, flow speed, turbulence intensity, electrode orientation, rate of voltage increase, and gas density through the addition of a diffuser. The second phase consisted of developing an interactive model which correctly reflects the dependences observed in phase one. A space-charge model resulted which correctly explains most major observed trends in gross discharge properties. Discharge stability is also discussed in terms of the model. Author (GRA)

N77-21439# Naval Research Lab., Washington, D. C.

OPTIMIZATION OF Nd:GLASS LASERS WITH PHOSPHATE-LASER GLASS

J. M. McMahon Nov. 1976 80 p refs

(NRL Proj. H02-29A)

(AD-A032285; NRL-MR-3411) Avail: NTIS HC A05/MF A01 CSCL 20/5

In this report the impact of phosphate base neodymium glass on laser design for fusion experiments is examined. It is shown that in an optimum amplifier this glass solves the self-focusing problems for pulses longer than 250 ps. Large systems (= 100 kJ) appear possible with this glass with overall

efficiencies on the order of 0.2% for nanosecond pulses. For short pulses this glass gives at least a factor of five improvement over silicate systems in terms of cost per terawatt. Phosphate optimized rod amplifier systems are also examined, and found far less desirable than the disc system, both in cost and complexity. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N77-21440 Engineering Sciences Data Unit, London (England).
GUIDE TO THE USE OF ITEM NO. 76005. KINEMATIC AND DYNAMIC DATA FOR CRANK-ROCKER AND SLIDER-CRANK LINKAGES Data Item
Apr. 1976 59 p
(ESDU-76005; ISBN-0-85679-141-5) For information on availability of series, sub-series, or individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. (write for prices)

Data are presented for crank-rocker design or analysis over the complete range of possible plane four-bar linkages of this class. The properties of the linkage are presented in the form of contours on a series of transparent graphs or overlays presented in terms of the linkage characteristic parameters lambda. In this way a linkage having particular required properties may be found (if it exists) by viewing the contours for each of the appropriate properties through a stack of overlays. The properties considered include the lengths of each link, the angle-of-swing of the rocker, the crank angle between dead-centers, extreme transmission angle, maximum rocker velocity, maximum crank torque due to rocker inertia, and maximum coupler end-load. ESDU

N77-21441*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF LARGE-BORE TAPERED-ROLLER BEARINGS UNDER COMBINED RADIAL AND THRUST LOAD AT SHAFT SPEEDS TO 15,000 RPM
Richard J. Parker and Hans R. Signer Washington Mar. 1977 25 p refs
(NASA-TN-D-8404; E-8825) Avail: NTIS HC A02/MF A01 CSCL 13I

The performance of 120.65-mm bore tapered roller bearings was investigated at shaft speeds up to 15,000 rpm. Temperature distribution and bearing heat generation were determined as a function of shaft speed, radial and thrust loads, lubricant flow rate, and lubricant inlet temperature. Lubricant was supplied by either jets or by a combination of holes through the cone directly to the cone-rib contact and jets at the roller small-end side. Cone-rib lubrication significantly improved high-speed tapered-roller bearing performance, yielding lower cone-face temperatures and lower power loss and allowing lower lubricant flow rates for a given speed condition. Bearing temperatures increased with increased shaft speed and decreased with increased lubricant flow rate. Bearing power loss increased with increased shaft speed and increased lubricant flow rate. Author

N77-21442# Polish Academy of Sciences, Warsaw.
THE ROLE OF THE UPPER LAYER IN PROCESSES OF DEFORMATION AND DECOHESION
P. Gadaj, Z. Handzell-Powierza, S. Ziemba, and S. Zukowski 11 Sep. 1976 33 p refs In POLISH
Avail: Issuing Activity

The processes of plastic deformation and plastic yield are studied. It was found that the surface layer plays an important role in the wear and durability of machine elements. Materials subjected to uniaxial symmetric tension display different microdeformation in the surface layer and in the center of a test bar. Therefore, the plastic deformation and plastic yield should be considered complex processes. Examples for the computation of the dynamic responses are presented. I.M.

N77-21443# National Aviation Facilities Experimental Center, Atlantic City, N. J.
STRUCTURAL TESTS OF PLASTIC FRANGIBLE COUPLINGS Final Report, May - Jun. 1976
Bret B. Castle Jan. 1977 26 p
(FAA Proj. 071-312-100)
(AD-A035096/7; FAA-NA-76-38; FAA-RD-76-202) Avail: NTIS HC A03/MF A01 CSCL 13/5

Tests were conducted on standard frangible couplings and a type of plastic frangible couplings to determine if they were equal to the specified requirements as far as resonant frequency, static loads, and impact loads were concerned. Results indicated that standard metal couplings were congruent with frangibility requirements, but the plastic couplings were not. Under static loads, the plastic units showed excessive bending and, when broken, failed to shear away cleanly. Impact testing indicated that the plastic couplings were much too sinewy to meet the frangibility standards presently required of the standard couplings. Author

N77-21444*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ESTIMATION OF STIFFENING EFFECT OF SHAFT AND HOUSING MATERIAL OUTSIDE PROJECTED AREA OF A ROLLING ELEMENT BEARING
Christopher M. Taylor Washington Apr. 1977 15 p refs
(NASA-TN-D-8465; E-9034) Avail: NTIS HC A02/MF A01 CSCL 13I

In the analysis of distortions occurring in rolling-element bearings, it is common to neglect the stiffening effect of shafting outside the bearing region. The magnitude of such an effect will be dependent primarily on the bearing width-to-bore ratio, the shaft geometry, and the location of the bearing on the shaft. An estimate is given of the stiffening effect for a wide range of these variables. In addition, brief consideration is given to the parallel situation existing at the outer ring housing. Author

N77-21445# Battelle Columbus Labs., Ohio.
FLANGED JOINTS WITH CONTACT OUTSIDE THE BOLT CIRCLE: ASME PART B DESIGN RULES
E. C. Rodabaugh and S. E. Moore May 1976 82 p refs
(Contract W-7405-eng-26)
(ORNL-Sub-2913-1) Avail: NTIS HC A05/MF A01

The ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, gives rules which are subdivided into 'Part A' and 'Part B'. Part A covers flanged joints where contact between flanges occurs through a gasket located inside the bolt holes. Part B covers flanged joints with contact outside the bolt holes. This report (a) summarizes the theory for Part B flanged joints, (b) presents examples which show the significant differences between Part A flanged joints and Part B flanged joints, (c) presents the available test data relevant to the characteristics of Part B flanged joints, (d) gives listings of two computer programs which can be used to evaluate the characteristics of Part B flanged joints, and (e) gives recommendations for Code revisions and other aspects of Part B flanged-joint design. ERA

N77-21446# Bendix Corp., Kansas City, Mo.
WELDING ELECTRIC TERMINALS ULTRASONICALLY
G. S. Darner Sep. 1976 33 p refs
(Contract E(29-1)-613)
(BDX-613-1565) Avail: NTIS HC A03/MF A01

Ultrasonic welding has been investigated for use on foil conductor terminations. Equipment and tooling have been improved; material considerations and combinations have been evaluated to determine their effects on the process; and special configurations and techniques have been studied to extend the applicability of the ultrasonic welding process. ERA

N77-21447# Battelle Pacific Northwest Labs., Richland, Wash. Dept. of Metallurgy.
TARGET MATERIAL WELD CLOSURE DEVELOPMENT
J. B. Correy 15 Feb. 1966 43 p refs
(Contract E(45-1)-1830)
(BNWL-CC-496) Avail: NTIS HC A03/MF A01

The development of high integrity gas tight closure welding processes for aluminum alloy enclosures for ceramic target material using a vented end cap is reported. The closure welds on both ends were made with the balanced wave alternating current tungsten inert gas shielded arc process using argon as a shielding gas. An expulsion type pin to plate type weld for sealing the vent hole was developed using a magnetic force welder. ERA

N77-21448# Bendix Corp., Kansas City, Mo.
BURRS PRODUCED BY END MILLING
L. K. Gillespie Sep. 1976 108 p refs
(Contract E(29-1)-613)
(BDX-613-1503) Avail: NTIS HC A06/MF A01

By controlling the size of burrs produced in machining operations, burr removal costs can be lowered, and the repeatability of the resulting edges improved. This investigation sought to determine how machining variables influence burr size in end-milling operations. It was concluded that the low feed rates which are commonly used in precision miniature machining create larger burrs than do more conventional feedrates. Dull tools double the size of burrs. Increasing the radial depth of cut also increases burr size on many edges. A single endmilling cut can produce eight different burrs. Burr properties vary noticeably even along a single edge. Burrs in 1018 steel, 6061-T6 aluminum, 303 Se, and 17-4 PH stainless were typically 0.003 inch thick. Burr heights ranged from 0.0001 to 0.070 inch. Conceptual and mathematical descriptions of burr formation have been developed. ERA

N77-21449# Bendix Corp., Kansas City, Mo.
ECONOMIC OPTIMIZATION TECHNIQUES APPLICABLE TO PRECISION MINIATURE MACHINING
L. K. Gillespie Sep. 1976 28 p refs Revised
(Contract E(29-1)-613)
(BDX-613-1512-Rev; PDO-6984735) Avail: NTIS HC A03/MF A01

Traditional techniques for optimizing the economics of fabricating precision miniature piece parts are not adequate when over 250 different fabrication processes are in use. Existing definitions of tool life are totally inadequate when they are applied to machining batch lots of precision miniature parts and this in turn affects machining economics. Eleven basic approaches to optimizing the economics of manufacturing precision miniature parts are described, including evaluating trade-offs between machining and deburring operations, using group technology, computer aided designs and direct numerical control, and implementing evolutionary optimization techniques. ERA

N77-21450# Bendix Corp., Kansas City, Mo.
ECONOMIC TRADEOFFS IN DEBURRING
L. K. Gillespie Sep. 1976 110 p refs
(Contract E(29-1)-613)
(BDX-613-1620) Avail: NTIS HC A06/MF A01

The reliability of small precision mechanisms depends on the production of burr-free, sharp-edged parts. The capabilities of the 24 major deburring processes were investigated. Other techniques for minimizing burr-related problems and assuring sharp-edged parts were studied. It is concluded that four approaches can be used to provide the required quality: prevent burrs from forming; minimize burr size by proper matching conditions; design parts to minimize deburring problems; and improve existing deburring techniques by defining and increasing capabilities. ERA

N77-21451# Sandia Labs., Albuquerque, N.Mex.
ENGINE DATA MEASUREMENT SYSTEM
C. W. Robinson Sep. 1976 18 p refs
(Contract E(29-1)-789)
(SAND-76-8245) Avail: NTIS HC A02/MF A01

The data measurement and reduction system for the Pouliot variable displacement engine uses a Hewlett Packard 2114A minicomputer. The raw data are processed to compute the horsepower, air-fuel ratio, equivalence ratio, brake specific fuel consumption, and brake specific emissions of unburned hydrocarbons, oxides of nitrogen, and carbon monoxide. Emissions are checked for consistency by applying the chemical equilibrium theory of Spindt. ERA

N77-21452# Royal Aircraft Establishment, Farnborough (England).
LONG LIFE BALL-BEARINGS FOR USE IN SATELLITES IN SEALED CONTAINERS
W. A. Ware Mar. 1976 41 p refs
(RAE-TR-76036; BR52828) Avail: NTIS HC A03/MF A01

The development of long life ball bearings with one initial lubrication is discussed. An experimental batch of 60 spindles fitted with several types of ball races was run for seven years. The conclusion is that a 10 year life should be reliably obtained for such devices as momentum or reaction wheels for satellite attitude control. Significantly longer reliable lives are probably possible. Author (ESA)

N77-21453# Texaco, Inc., Beacon, N.Y.
A PERFORMANCE MODEL FOR THE TEXACO CONTROLLED COMBUSTION, STRATIFIED CHARGE ENGINE
Bhag C. Jain, James C. Keck, and Joe M. Rife Jan. 1976 53 p refs Prepared by MIT, Cambridge
(Contracts DAAE07-73-C-0282; DAAE07-74-C-0268; DAAE07-74-C-0168)
(AD-A031330; FML-76-2) Avail: NTIS HC A04/MF A01 CSCL 21/7

A model has been developed to predict the performance of the Texaco Controlled Combustion, Stratified Charge Engine starting from engine geometry, fuel characteristics, and the operation conditions. This performance model divides the engine cycle into the following phases: Intake, Compression, Rapid Combustion, Mixing - Dominated Expansion, Heat - Transfer Dominated Expansion, and Exhaust. During the rapid combustion phase, the rate of heat release is assumed to be controlled by the rate of fuel injection and the gas-to-fuel ratio. Entrainment of the surrounding gas by the plume is assumed to be controlled by the turbulent eddy entrainment velocity. A plume geometry model has been developed to obtain the surface area of the plume for entrainment during the mixing dominated phase. The model also gives the wall areas in contact with the hot, burned gas plume and the relatively cold unburned gas for heat transfer calculations. Comparison of the model predictions with the available experimental data shows good agreement. In addition, the potential of the performance model as a design tool is demonstrated with a parametric analysis. Author (GRA)

N77-21454# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
FUEL AND LUBRICANT COMPATIBILITY STUDIES FOR ARMY HIGH-OUTPUT TWO-CYCLE DIESEL ENGINES Interim Report, Sep. 1972 - Sep. 1975
Sidney J. Lestz, Thomas C. Bowen (Army Mobility Equipment Res. and Develop. Center), and Maurice E. LePera (Army Mobility Equipment Res. and Develop. Center) Sep. 1976 50 p refs
(Contracts DAAD05-70-C-0250; DAAK02-73-C-0221; DAAG53-76-C-0003)
(AD-A031885; AFLRL-80; SAE-760717) Avail: NTIS HC A03/MF A01 CSCL 21/4

A high-output Army two-cycle diesel engine was subjected to proving-ground related laboratory-dynamometer endurance test cycles using four different qualified MIL-L-2104C SAE grade 30 lubricants. Three diesel fuels differing mainly in sulfur level and end point temperature were an important part of the test matrix. Two lubricants (low- and mid-ash level) produced acceptable performance and a third (of high-ash level) was considered borderline acceptable--all during operation with reference No. 2 diesel fuel (0.42% wt sulfur). A fourth oil (low-ash level) was judged to be incompatible due to its proneness to severe piston and liner scuffing. The engine was judged incompatible with a high sulfur/high end-point (1.2%S/396 C (744 F) EP) fuel intended to meet MIL-F-16884F (Marine Diesel Fuel) using two different MIL-L-2104C lubricants. This engine was also judged to be incompatible with a special blend to NATO F-54 diesel fuel (0.64% sulfur) during operation with the same two lubricants. Incompatibility using fuel sulfur levels greater than 0.50% was based on the occurrence of catastrophic piston/ring/exhaust valve failure and relatively high deposit and wear levels. Author (GRA)

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N77-21455# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
TOLERANCE CHALLENGE
G. R. Frank Jan. 1977 9 p refs To be presented at 31st Ann. A.S.Q.C. Tech. Conf., Philadelphia, 16-18 May 1977
(X76-1621/101) Avail: NTIS HC A02/MF A01

Positional tolerance better known as true position before the 1973 ANSI Y 14.5 change, is a type of tolerancing with significant advantages. The tolerance is a means of expressing design intent clearly, leaving nothing to the imagination or judgement of the user. The tolerance is being used, in some cases, improperly. The problems encountered with positional tolerance on the engineering drawings are two fold, i.e., conversion from coordinate to positional tolerance and using an interference formula in lieu of an assembly clearance tolerance. Author

N77-21456# Bendix Corp., Kansas City, Mo.
COMPUTER AIDED FAILURE ANALYSIS
R. S. Smith Sep. 1976 16 p refs
(Contract E(29-1)-613)
(BDX-613-1522-Rev; PDO-6984893) Avail: NTIS HC A02/MF A01

A computer aided failure analysis system (CAFA) is being developed to troubleshoot defects in electronic assemblies. Through a question and answer procedure, the system provides step by step directions to guide a troubleshooter to the fault location. A diagnostic logic routine has been established for one product, and the software necessary to store and implement the routine has been developed. The time share operation (TSO) terminal has been installed, and the completed system has been found to be functional. A visual aid catalog has been developed for the current CAFA routine. ERA

N77-21457# Bendix Corp., Kansas City, Mo.
LOW TEMPERATURE ALUMINUM SOLDERING ANALYSIS
W. G. Peterkork Sep. 1976 48 p refs
(Contract E(29-1)-613)
(BDX-613-1557) Avail: NTIS HC A03/MF A01

The investigation of low temperature aluminum soldering included the collection of spread factor and dihedral angle data for several solder alloys and a study of flux effects on aluminum. Selected solders were subjected to environmental tests and evaluated on the basis of tensile strength, joint resistance, visual appearance, and metallurgical analysis. A production line method for determining adequate flux removal was developed. ERA

N77-21458# Mound Lab., Miamisburg, Ohio.
SEMI-AUTOMATED X-RAY GAUGING PROCESS CONTROL SYSTEM
C. F. Draut and D. A. Homan 8 Oct. 1976 18 p refs Presented at Monsanto Process Computer Symp., Pensacola, Fla., 8 Aug. 1976
(MLM-2363(OP); Conf-760827-2) Avail: NTIS HC A02/MF A01

An X-ray gauging method was developed and a production gauging system was subsequently fabricated to control the quality of precision manufactured components. The gauging system measures via X-ray absorption the density of pressed finely divided solids held in a dissimilar container. The two dissimilar materials condition necessitated a 'two scan' technique: first, the X-ray attenuation of the empty container prior to loading and then, the attenuation of the loaded container are measured; that is, four variables. The system provided greatly improved product control via timely data feedback and increased product quality assurance via 100 percent inspection of product. In addition, it reduced labor costs, product cost, and possibilities for human errors. ERA

N77-21459# Battelle Northwest Labs., Seattle, Wash.
NON-DESTRUCTIVE TUBE TESTING BENCH WITHOUT ROTATION
J. Perdijon [1977] 9 p refs Transl. into ENGLISH from Bull. Inf. Sci. Tech. (Paris), no. 211, Feb. 1976 p 55-59
(Contract E(45-11)-1830)
(BNWL-tr-193) Avail: NTIS HC A02/MF A01

On-line testing by ultrasonics in combination with eddy currents would represent a large saving in time and equipment since the tube to be checked would only need to pass once quickly and without rotation. The answer to this problem is to use encircling transducers, which means that the mirror interposed to detect transverse defects must be conical while that used to detect longitudinal defects is helical shaped. A cell combining these two mirrors with an eddy current coil to test thin small-diameter tubes is described. The first trail year shows that defects are detected independently of their position, with a sensitivity at least equal to that of conventional systems. ERA

N77-21460# Naval Postgraduate School, Monterey, Calif.
ACCURACY ANALYSIS FOR A LOWER CONFIDENCE LIMIT PROCEDURE FOR SYSTEM RELIABILITY M.S. Thesis
Thomas Robert Gatliffe Sep. 1976 99 p refs
(AD-A031817) Avail: NTIS HC A05/MF A01 CSCL 14/4

This thesis examines a proposed empirical method for determining the 100 (1-alpha) per cent lower confidence limit for the reliability of a system composed of a mixture of series and parallel connected components for which only component level test data is available. The method is an extension of the Log-gamma procedure originally proposed for series connected systems only. The accuracy of the method is assessed for some representative system reliability constructs using a computer simulation procedure. The simulation results are examined with a view toward identification of accuracy indication parameters which may be estimated prior to the component tests. GRA

N77-21461# Naval Research Lab., Washington, D. C.
DESIGN AND VERIFICATION CRITERIA FOR MISSILE WEIGHT-HANDLING EQUIPMENT
E. R. Seibert, J. M. Krafft, H. L. Smith, and George J. OHara Oct. 1976 59 p refs
(AD-A031989; NRL-MR-3387) Avail: NTIS HC A04/MF A01 CSCL 16/4

This report describes an NSPO sponsored task to evaluate the safety and structural reliability of TRIDENT-C4 missile handling equipment. In a first phase, draft of new design specifications was examined in view of current government and industry criteria for similar service. In this second phase, design stress allowables as well as a proof loading test policy for verification of structural integrity were assessed by study and experimental programs. Structural elements of mild steel and aluminum alloy weldments and of steel wire rope are taken to typify this service. Potential sources of initial and/or use-related failure include welding defects, cold cracking, lamellar tearing, fatigue, and salt water corrosion. A structural specimen consisting of a spreader beam and wire rope pendants was designed, then tested in static and fatigue loading, with simulated proof test loadings; both air and salt water environments were imposed. Failure of the spreader beams was caused by crack propagation from a weld, with fatigue life consistent with literature data. The wire rope pendants also failed by fatigue crack propagation in the wires adjacent the core. Here the proof test overload was found to delay the fatigue damage, hence lengthen its life. A new technique is proposed for detecting broken wires inside the rope. Author (GRA)

N77-21462# Rockwell International Corp., Thousand Oaks, Calif. Rocketdyne Div.
RELIABILITY TOLERANCE BOUNDS Final Report, 1 Apr. 1971 - 30 Jun. 1976
Nancy R. Mann Aug. 1976 13 p refs
(Contract F44620-71-C-0029; AF Proj. 9769)
(AD-A031280; R76-111; AFOSR-76-1114TR) Avail: NTIS HC A02/MF A01 CSCL 14/4

This report gives a comprehensive review of accomplishments on reliability tolerance levels under the contract during the period 1 April 1971 through 30 June 1976. It includes a bibliography of all papers resulting from research performed under the contract. GRA

N77-21463# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
A CRACK GROWTH GAGE FOR ASSESSING FLAW GROWTH POTENTIAL IN STRUCTURAL COMPONENTS Final Report, Mar. - Jul. 1976
R. L. Crane, A. F. Grandt, and J. P. Gallagher Oct. 1976 22 p refs
(AF Proj. 2279)

(AD-A033574; AFML-TR-76-174) Avail: NTIS HC A02/MF A01 CSCL 11/6

A new concept for monitoring the potential for damage accumulation in structural materials is presented. Briefly, the method proposed is to install a preflawed gage on a critical component and to monitor its flaw growth nondestructively. The relationship between this flaw size and the potential flaw in the structure is derived using linear elastic fracture mechanics principles. Experimental flaw growth data produced by an aircraft spectrum was used to demonstrate the validity of a degenerate case of this concept. A discussion is also presented to show how this method could be implemented in fulfillment of the Mil-Std-1530 requirement to track potential flaw growth. GRA

N77-21464# Harry Diamond Labs., Adelphi, Md.
RADIOGRAPHIC EVALUATION OF POTTING VOIDS IN ELECTRONIC FUZES
Ruth Chaddick Nov. 1976 23 p refs Sponsored by Army Materials and Mechanics Research Center
(HDL Proj. 789374)
(AD-A033086; HDL-TR-1767) Avail: NTIS HC A02/MF A01 CSCL 19/1

As a first step in the development of techniques for detecting voids in low-density polyurethane potting foam (encased in steel) for electronic fuzes, several radiological sources were explored, and several imaging systems were investigated. Although neutron radiography is not practical at the present time, it warrents further research. A void 0.1 x 0.5 in. was discernible through steel, but neutron radiography required a 60-min exposure time and an overnight decay onto film. A scintillation system utilizing X-ray radiography with a scanning detector proved to be more compatible with factory inspection. The same size void was discernible through aluminum and, with a few refinements, this system promises to describe even smaller voids through aluminum and steel. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N77-21465 Engineering Sciences Data Unit, London (England).
FATIGUE STRENGTH OF LONGITUDINAL FLANGE-TO-WEB WELDS IN STEEL I-BEAMS AND T-SECTIONS Data Item
Nov. 1976 8 p
(ESDU-76032; ISBN-0-85679-169-5) For information on availability of series, sub-series, or individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. (write for prices)

Data are presented on the as-welded fatigue strength of symmetrical section I-beams and T-sections built up from flat steel plate using longitudinal flange-to-web welds. Data are presented for continuous automatic and manual welds, both with and without full penetration, and for discontinuous fillet welds. The I-beams were tested in simple bending under three- and four-point loading. The T-sections were loaded axially and uniformly across their complete cross-section. ESDU

N77-21466 Engineering Sciences Data Unit, London (England).
FATIGUE CRACK PROPAGATION IN LOW AND MEDIUM STRENGTH LOW ALLOY STEEL PLATE, BAR AND FORGINGS Data Item
Nov. 1976 15 p
(ESDU-76031; ISBN-0-85679-168-7) For information on availability of series, sub-series, or individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. (write for prices)

Data are presented on the rate of growth of fatigue cracks in low and medium strength low alloy steel plate, bar, and forgings. A low alloy steel is defined as a steel where the percentage contribution of any particular alloying element is less than 5 per cent. The chemical composition and mechanical properties of the materials are given and are tabulated in order of increasing values of their 0.2 per cent proof stresses. ESDU

N77-21467*# Lockheed-California Co., Burbank.
A 100-kW METAL WIND TURBINE BLADE BASIC DATA, LOADS AND STRESS ANALYSIS Final Report
A. W. Cherritt and J. A. Gaidelis Jun. 1975 241 p ref
(Contract NAS3-19235)
(NASA-CR-134956; LR-27153) Avail: NTIS HC A11/MF A01 CSCL 13M

A rotor loads computer program was used to define the steady state and cyclic loads acting on 60 ft long metal blades designed for the ERDA/NASA 100 kW wind turbine. Blade load and stress analysis used to support the structural design are presented. For the loading conditions examined, the metal blades are structurally adequate for use, within the normal operating range, as part of the wind turbine system. Author

N77-21468*# Lockheed-California Co., Burbank.
A 100-kW WIND TURBINE BLADE DYNAMICS ANALYSIS, WEIGHT-BALANCE, AND STRUCTURAL TEST RESULTS Final Report
W. D. Anderson Jun. 1975 102 p refs
(Contract NAS3-19235)
(NASA-CR-134957; LR-27230) Avail: NTIS HC A06/MF A01 CSCL 13M

The results of dynamic analyses, weight and balance tests, static stiffness tests, and structural vibration tests on the 60-foot-long metal blades for the ERDA-NASA 100-kW wind turbine are presented. The metal blades are shown to be free from structural or dynamic resonance at the wind turbine design speed. Aeroelastic instabilities are unlikely to occur within the normal operating range of the wind turbine. Author

N77-21469*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INCLUSION OF EXPLICIT THERMAL REQUIREMENTS IN OPTIMUM STRUCTURAL DESIGN
Howard M. Adelman and Patricia L. Sawyer Mar. 1977 41 p refs
(NASA-TM-X-74017) Avail: NTIS HC A03/MF A01 CSCL 13M

A finite-element based procedure is described for obtaining minimum mass designs of structures subjected to combined thermal and mechanical loading and both strength and thermal constraints. The procedure is based on a mathematical programming method using the Sequence of Unconstrained Minimizations Technique (SUMT) in which design requirements are incorporated by an exterior penalty function. The procedure is limited to steady-state temperatures which are controlled by structural sizing only. The optimization procedure is demonstrated by the design of a structural wing box with both mechanical loading and external heating, subject to design constraints on stress, minimum gage, and temperature. The final design for these conditions is compared with a corresponding design in which temperature constraints are omitted. Author

N77-21470*# Old Dominion Univ. Research Foundation, Norfolk, Va.
ANALYTICAL AND NUMERICAL INVESTIGATION OF STRUCTURAL RESPONSE OF COMPLIANT WALL MATERIALS Final Report, 26 Aug. 1975 - 30 Nov. 1976
G. L. Goglia and R. Balasubramanian Apr. 1977 89 p refs
(Grant NsG-1236)
(NASA-CR-152653) Avail: NTIS HC A05/MF A01 CSCL 13M

Surface motion of compliant walls in drag reduction experiments was analyzed. The spectrum of surface motion indicates that membranes over deep cavities respond at low frequencies and large wavelengths. The membrane over a deep cavity is therefore found not to yield the desired reponse predicted by the postulated mechanism. The membrane over a thin air gap is found to act as a wavelength chopper, and analysis of the nonlinear response of the compliant surface indicates its possible suitability for compliant wall experiments. Periodic structures are found to lock in the desired wavelengths of motion. Laminated structures are found to be very ineffective as compliant models, except when there is no bonding between the membrane and the backing. Computer programs developed for these analyses are documented. Author

N77-21471# Waterloo Univ. (Ontario). Solid Mechanics Div.
PLASTIC ANALYSIS UNDER COMBINED STRESSES
Donald E. Grierson and Saleh B. Abdel-Baset Aug. 1976 49 p refs Presented at 1st ASCE-EMD Specialty Conf. on Mech. in Eng., Waterloo, Ontario, Canada, 26-28 May 1976 Submitted for publication
(Paper-139) Avail: NTIS HC A03/MF A01

The collapse-load analysis problem for discrete structures under combined stress resultants governed by PWL (piecewise linear) constitutive laws is reviewed. Matrix algebra techniques applied to a generic frame-element are employed to develop the dual static and kinematic LP (lines programming) statements of the rigid-plastic analysis. For the case when the actual (nonlinear) yield conditions for the frame-elements are unknown, the same LP formulations are directly applied to the plastic analysis of discrete cross-sections under combined stresses (normal, shearing) to find appropriate PWL yield surfaces. Decomposition techniques are introduced with a view to numerical efficiency, and several worked examples concerning both cross-sections and frameworks are presented. Author

N77-21472# Lockheed Missiles and Space Co., Palo Alto, Calif.
PRINCIPLES OF THE THEORY OF PHYSICALLY NONLINEAR BODIES
I. A. Tsurpal [1976] 15 p refs Transl. into ENGLISH from the book "Raschet elementov konstruktsii iz nelineinouprugikh materialov" Kiev, Tekhnika, 1976 p 5-20
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The influence of a physical nonlinearity on the stress state in the stress concentration zone of elastic materials is investigated. In the case of active deformation (loading), the theory of an elastic-plastic body is none other than the theory of a nonlinearly elastic body with an identical tension diagram. Only in the case of passive deformation (unloading), is the theory of nonlinearly elastic body different from that of a plastic body. Equations are presented for the plane problem of the physically nonlinear theory of elasticity for designing elements of structures from metallic and highly resilient materials. Author

N77-21473*# Southwest Research Inst., San Antonio, Tex.
TRANSIENT EXCITATION AND MECHANICAL ADMITTANCE TEST TECHNIQUES FOR PREDICTION OF PAYLOAD VIBRATION ENVIRONMENTS Final Report
Daniel D. Kana and Luis M. Vargas Washington NASA Mar. 1977 39 p refs
(Contract NAS1-13813)
(NASA-CR-2787; SwRI-02-4202) Avail: NTIS HC A03/MF A01 CSCL 22B

Transient excitation forces were applied separately to simple beam-and-mass launch vehicle and payload models to develop complex admittance functions for the interface and other appropriate points on the structures. These measured admittances were then analytically combined by a matrix representation to obtain a description of the coupled system dynamic characteristics. Response of the payload model to excitation of the launch vehicle model was predicted and compared with results measured on the combined models. These results are also compared with results of earlier work in which a similar procedure was employed except that steady-state sinusoidal excitation techniques were included. It is found that the method employing transient tests produces results that are better overall than the steady state methods. Furthermore, the transient method requires far less time to implement, and provides far better resolution in the data. However, the data acquisition and handling problem is more complex for this method. It is concluded that the transient test and admittance matrix prediction method can be a valuable tool for development of payload vibration tests. Author

N77-21474# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Aerospace Nuclear Safety Program.
STRESS ANALYSIS OF DISCONNECTED STRUCTURES IN CONTACT THROUGH FINITE GAPS
J. T. Stadter and R. O. Weiss Jul. 1976 61 p refs
(Contract E(49-15)-3060)
(ANSP-M-13; DNRA-3060-13) Avail: NTIS HC A04/MF A01

A numerical procedure is presented for analyzing thermal stress problems of disconnected structures in contact across separations or gaps. The procedure is called SAASGAPS, an adaptation of the basic SAAS III computer program. The SAAS program uses the finite element method and allows analyses of plane and axisymmetric bodies with temperature dependent material properties, subject to thermal and mechanical loads. A secant modulus approach with a bilinear stress-strain curve is used for elastic-plastic problems. The SAASGAPS version contains all of the features of the original SAAS program. A special gap element is used together with a stress invariance principle to model the contact process. The iterative procedure implemented in SAASGAPS is described. Results are discussed for five problems involving frictionless contact. ERA

N77-21475# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
EXPERIMENTAL STRESS ANALYSIS OF THE ATTACHMENT REGION OF HEMISPHERICAL SHELLS WITH ATTACHED NOZZLES. PART 2C. RADIAL NOZZLE: 7.875 IN. OD; 7.500 IN. ID; ZERO PENETRATION
R. L. Maxwell, R. W. Holland, and J. N. Kanianthra 15 Jun. 1976 158 p Sponsored in part by Nucl. Regulatory Comm. Prepared for ORNL
(Contract W-7405-eng-26)
(ORNL-SUB-2203-4) Avail: NTIS HC A08/MF A01

Stress data and the various stress vs. profile curves for tests conducted on a steel hemisphere with a radially attached cylindrical nozzle are presented. ERA

N77-21476# Southampton Univ. (England). Inst. of Sound and Vibration Research.
DISTORTED CYLINDRICAL SHELL RESPONSE TO INTERNAL ACOUSTIC EXCITATION BELOW THE CUT-OFF FREQUENCY
S. N. Yousri and F. J. Fahy Jan. 1976 34 p refs Sponsored by Babcock & Wilcox (Operations) Ltd.
(ISVR-TR-82) Avail: NTIS HC A03/MF A01

The mechanism of coupling between a planewave acoustic mode and a non-axisymmetric structural mode of a thin wall, circular, cylindrical shell, via the geometrical distortion of the shell is considered. A theoretical model of response below the acoustic cut-off frequency is used to estimate the vibration level induced in a tube having small circumferential variations of wall thickness, radius and modulus of elasticity. The results have been confirmed experimentally; for small distortion the modal response amplitude varies linearly with the distortion in thickness and radius in the form sq a/h (where a is the shell radius and h is the shell thickness); also it is inversely proportional to the variation of Young's modulus. Author (ESA)

N77-21477# Southampton Univ. (England). Inst. of Sound and Vibration Research.
FREQUENCY RESPONSE TESTING AT HIGH FREQUENCY IN A NOISE ENVIRONMENT WITH PARTICULAR REFERENCE TO CONDITION MONITORING
M. F. White Apr. 1976 112 p refs Sponsored by Sci. Res. Council
(ISVR-TR-84) Avail: NTIS HC A06/MF A01

Condition monitoring of rotating machinery demands a knowledge of the frequency response characteristics of machine structures over a wide frequency range. The problems of high frequency vibration testing are considered both theoretically and experimentally with particular reference to frequency response measurement in a noisy environment. The linear swept sinewave transient excitation method was applied to both simple and more typical test structures, and techniques for signal to noise ratio improvement were investigated. The improvement in accuracy of transient test data using ensemble averaging was found to be governed by the timebase stability of the excitation signal and frequency resolution. Finally, a method of inverse transformation was considered to enable signals from components within a machine to be related to the exciting force with the aid of transfer functions. Author (ESA)

N77-21478# Ecole Nationale Superieure de Techniques Avancees, Paris (France).
DESCRIPTION AND ELABORATION OF A DYNAMIC ELLIPSOMETER. APPLICATION TO DYNAMIC PHOTOELASTIC ANALYSIS [DESCRIPTION ET ELABORATION

D'UN ELLIPSOMETRE DYNAMIQUE. APPLICATION A LA PHOTOELASTICIMETRIE DYNAMIQUE]
M. Ferre Jul. 1976 84 p refs In FRENCH
(Rept-073) Avail: NTIS HC A05/MF A01

A new type of dynamic ellipsometer based on representation forms of light and optical operator algebra is described. The application of the ellipsometer to dynamic photoelastic analysis is illustrated for shock and vibration tests. ESA

N77-21479# Royal Aircraft Establishment, Farnborough (England). Dept of Structures.
SCATTER IN FATIGUE: ELEMENTS AND SECTIONS FROM AIRCRAFT STRUCTURES
A. M. Stagg London Aeron. Res. Council 1976 38 p refs Supersedes RAE-TR-69155; ARC-31639
(ARC-CP-1357; RAE-TR-69155; ARC-31639) Avail: NTIS HC A03/MF A01; HMSO £1.80; PHI $7.20

The fatigue test results, for elements and sections from the structures of aircraft, obtained by a number of experimenters are analyzed in terms of the scatter present in the lives to fatigue failure. Data for structures made of any light alloy material and tested under any form of loading have been included in an attempt to increase the definition of any trends noted in the scatter, which was calculated using a log-normal distribution of fatigue lives as a basis. Author (ESA)

N77-21480# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
A CONTRIBUTION TO THE ANALYSIS OF SLOW STABLE CRACK GROWTH
A. U. deKoning Aug. 1976 19 p refs Presented at the 14th Intern. Congr. of Theoret. and Appl. Mech., Delft, Neth., 30 Aug.-4 Sep. 1976
(NLR-MP-75035-U) Avail: NTIS HC A02/MF A01

The finite element method was used to analyze the behavior of some well known crack growth parameters, such as the value of the J-integral, the crack driving force, and the crack opening displacement. Further, the rate of energy dissipation at the crack tip was studied. Crack growth is realized by disconnecting finite elements. The method is applied in an analysis of experimental data obtained for centrally cracked sheet specimens. Author (ESA)

N77-21481# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
APPLICATION OF FRACTURE MECHANICS IN DESIGNING BUILT-UP SHEET STRUCTURES
H. Vlieger 9 Sep. 1976 20 p refs Presented at the AGARD Specialists' Meeting on Fracture Mech. Design Methodology, London, 28-29 Sep. 1976
(NLR-MP-76024-U) Avail: NTIS HC A02/MF A01

Different analyses (static strength, crack initiation and propagation, and residual strength) relevant to the design of a fail-safe aircraft structure are discussed in order to restrict the occurrence of cracks and to guarantee some specified life of the aircraft if cracks nevertheless arise. The crack propagation and residual strength analyses are discussed with respect to application of fracture mechanics principles and sheet structures. The factors that influence the effectiveness of a fail-safe design and ways in which fail-safe properties can be improved are discussed. ESA

N77-21482# Aeronautical Research Inst. of Sweden, Stockholm.
MODIFICATION OF A FINITE ELEMENT PROGRAM TO CONSIDER THE NON-LINEAR MATERIAL BEHAVIOUR OF ORTHOTROPIC LAMINATED STRUCTURES
Ingvar Haellgren Feb. 1976 54 p refs
(Contract SWEDBTD-73-5570)
(FFA-TN-HU-1669) Avail: NTIS HC A04/MF A01

A finite element program, BASIS 1, specially designed for analysis of two-dimensional orthotropic structures, was modified and routines were added which take into consideration the non-linear mechanical behavior of the material. The resulting program, BASIS PL, was designed for reliable analyses of stresses, strains, and deformations, especially in highly loaded laminated fiber reinforced epoxy structures subjected to stress redistribution due to plastic deformations, and cracking in the matrix. The scope and limitations of the program are described, as well as the different input and output options. Author (ESA)

N77-21483# Aeronautical Research Inst. of Sweden, Stockholm.
CREEP BUCKLING OF SHELLS OF REVOLUTION. USER'S MANUAL FOR PROGRAM DSOR 06
L. A. Samuelson 1975 56 p refs
(Contract SWEDBTD-71-839/U675-73/74)
(FFA-HU-1548-Pt-4) Avail: NTIS HC A04/MF A01

A method of analysis of creep deformations of shells of revolution was developed based on non-linear shell equations and assumption of secondary creep according to Norton power law. The computer code developed by Ball was utilized and modified in a number of ways to account for the changes in the theory caused by the inclusion of the creep deformations. Results are presented for a number of different test cases which indicate good agreement with the buckling behavior observed in experiments. The user's manual including an illustrative example is given in appendix A. Author (ESA)

N77-21484# Michigan Dept. of State Highways and Transportation, Lansing. Research Lab. Section.
EVALUATION OF A MODEL FOR PREDICTING TRANSVERSE CRACKING OF FLEXIBLE PAVEMENT Final Report, Sep. 1973 - Jan. 1976
E. C. Novak, Jr. Feb. 1976 37 p refs Sponsored by DOT
(PB-260885/9; R975; FHWA/RD/M-0338) Avail: NTIS HC A03/MF A01 CSCL 13B

A study was done comparing actual transverse cracking performance with that predicted by the Hajek-Haas method. No functional relationship was found to exist, and a limited laboratory study was conducted in an attempt to determine why. The study also considered the fact that transverse cracking in Michigan could have been essentially eliminated using McLeod's mix stiffness criteria; however, these criteria would exclude from use many stiff bituminous mixes which have given essentially crack-free service. Results indicated that the tensile strength, as well as stiffness modulus, both influence a bituminous mix's ability to resist cracking. Since stiffness modulus and tensile strength are not necessarily related, both should be included in models for predicting transverse cracking. Aggregate tensile strength also has a significant effect on the tensile strength of the mixes, thus mix tensile strength should not be estimated from asphalt cement properties alone. GRA

N77-21485# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
A STUDY OF THE VIBRATIONAL CHARACTERISTICS OF TWO MULTISTORY BUILDINGS Ph.D. Thesis
Douglas Allen Foutch Sep. 1976 213 p refs
(Grant NSF ATA-74-19135)
(PB-260874/3; EERL-76-03) Avail: NTIS HC A10/MF A01 CSCL 13M

Forced vibration tests and associated analysis of two multistory buildings (the Millikan Library on the California Institute of Technology campus, a nine-story reinforced concrete shear wall building; and The Ralph M. Parsons World Headquarters building, Pasadena, California, a twelve-story steel frame structure) are described. In one case, the dynamic properties of the building measured during tests are compared to those predicted by simple analytical models. A three-dimensional finite element model of the second building was constructed for the purpose of evaluating the accuracy of this type of analysis for predicting the observed dynamic properties of the structure. GRA

N77-21486# Battelle Columbus Labs., Ohio.
MECHANICAL FRACTURE PREDICTIONS FOR SENSITIZED STEEL PIPING WITH CIRCUMFERENTIAL CRACKS Final Report
T. Oldberg Sep. 1976 176 p refs
(EPRI Proj. 585-1)
(PB-260561/6; EPRI-NP-192) Avail: NTIS HC A09/MF A01 CSCL 18J

Circumferential intergranular stress corrosion cracks were discovered in the heat-affected zones of girth welds in the Type 304 stainless steel recirculation bypass piping systems of several boiling water reactor plants. To determine the residual strength of the cracked pipe, an integrated program of small-scale

laboratory experiments full-scale pipe tests, finite-element computation, and a mechanical failure analysis was conducted. After investigating several candidates, the work showed that a simple plastic collapse criterion can most effectively be used to predict failure in Type 304 stainless steel pipes with circumferential cracks. Recommendations for extending the work to permit more accurate and more widely applicable predictions of the margin of safety for arbitrarily shaped cracks in pipes are also given in the report. GRA

N77-21487# California Univ., Berkeley. Earthquake Engineering Research Center.
CAPACITY OF COLUMNS WITH SPLICE IMPERFECTIONS
E. P. Popov, R. M. Stephen, and R. Philbrick Sep. 1976 63 p refs Sponsored in part by Am. Inst. of Steel Construction
(Grant NSF AEN-73-07732-A02)
(PB-260378/5; EERC-76-21) Avail: NTIS HC A04/MF A01 CSCL 13M

The behavior of two W 14x176 columns with the currently allowed 1/16 in. gaps at the splices, and two similar columns with 1/4 in. gaps and shims was compared with the behavior of an unspliced column of the same size. The results showed that the lack of perfect contact at the compression splices of these stubby columns is not serious, provided that the gaps are carefully shimmed, and welding is used to maintain sections in alignment. After completing the compression tests the specimens were tested in tension. Since only minimum partial penetration welds along the flanges were provided at the splices, all failures occurred through the welds. GRA

N77-21488# California Univ., Berkeley. Earthquake Engineering Research Center.
EXPERIMENTAL AND ANALYTICAL STUDIES ON THE HYSTERETIC BEHAVIOR OF REINFORCED CONCRETE RECTANGULAR AND T-BEAMS
Shao-Yeh M. Ma, Vitelmo Bertero, and Egor P. Popov May 1976 264 p refs
(Grant NSF GI-36387)
(PB-260843/8; EERC-76-2) Avail: NTIS HC A12/MF A01 CSCL 13M

The inelastic behavior of critical regions that may develop in a beam near its connection with the column of a reinforced concrete ductile moment-resisting space frame when subjected to severe earthquake excitations was investigated using nine cantilever beams, representing half-scale models of the lower story girder of a 20-story ductile moment-resisting reinforced concrete office building, descriptions of the specimens, testing procedures, experimental data, and results obtained are presented. The significance of the experimental results in relation to the seismic design of the reinforced concrete critical region is also discussed. GRA

N77-21489# California State Dept. of Transportation, Sacramento. Transportation Lab.
REHABILITATION OF FAULTED PAVEMENTS BY GRINDING Interim Report, 1965 - 1975
B. F. Neal and J. H. Woodstrom Feb. 1976 27 p Sponsored by Federal Highway Admin.
(PB-260409/8; CA-DOT-TL-5167-4-76-18; FHWA-RD-76-S0535) Avail: NTIS HC A03/MF A01 CSCL 13B

The grinding of PCC pavements to restore riding quality which had deteriorated due to faulting of joints is reported. The results show that grinding is a satisfactory method of restoring smoothness provided the pavement is structurally adequate. Even though faulting may recur on some projects within a few years after grinding, service life was shown to be extended a significant length of time at a cost considerably less than that of an overlay. To prevent the recurrence of faulting on a ground pavement, a recommendation is made to provide a nonerodible material in the outer shoulder adjacent to the pavement. GRA

N77-21490# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
HIGHER MODAL DYNAMIC PLASTIC BEHAVIOR OF BEAMS LOADED IMPULSIVELY Interim Report
Norman Jones and C. A. P. Guedes Soares Oct. 1976 56 p refs
(Contract N00014-76-C-0195)
(AD-A031807; Rept-76-5) Avail: NTIS HC A04/MF A01 CSCL 20/11

The higher modal dynamic plastic response of fully clamped beams has been examined using various rigid perfectly plastic theoretical procedures and a numerical elastic-plastic computer code. The theoretical predictions agree reasonably well with the corresponding experimental values on strain rate insensitive beams which were subjected to first and second modal initial velocity distributions. However, all the experimental results for the third mode case lie below the various theoretical methods and numerical results, the reason for which is possibly due to the neglect of transverse shear effects. GRA

N77-21491# Massachusetts Inst. of Tech., Cambridge. Acoustics and Vibration Lab.
VIBRATION OF AND ACOUSTIC RADIATION FROM A PANEL EXCITED BY ADVERSE PRESSURE GRADIENT FLOW Technical Report, Oct. 1974 - 31 Mar. 1975
Yi Mason Chang and Patrick Leehey May 1976 37 p refs
(Contract N00014-67-A-0204-0002; SR0090101)
(AD-A032070; A/V-70208-12) Avail: NTIS HC A03/MF A01 CSCL 20/1

Flow with uniform adverse pressure gradient was created over the surface of a steel test plate. Vibration velocity levels on the plate and acoustic radiation from the plate were measured and compared with theoretical estimates. The measured vibration levels agree with theory for frequencies above those for hydrodynamic coincidence. Below these frequencies theoretical predictions of vibration levels are too high, but theoretical predictions of radiated sound power, based on measured vibration levels, are too low. Possible reasons for these compensating errors are discussed. Author (GRA)

N77-21492# Oakland Univ., Rochester, Mich. School of Engineering.
CYCLIC STRESS STUDIES BY TIME-AVERAGED PHOTOELASTICITY
Y. Y. Hung, C. Y. Liang, J. D. Hovanesian, and A. J. Durelli Nov. 1976 24 p refs
(Contract N00014-76-C-0487; Grant NSF ENG-76-08751)
(AD-A032086) Avail: NTIS HC A02/MF A01 CSCL 20/11

This paper describes an experimental method whereby the amplitude of cyclic stresses may be readily determined by time-averaged photoelasticity. Using an ordinary polariscope with a monochromatic light source, time-averaged isochromatics fringes are formed if the photographic film in the camera is exposed with an exposure time equal to one or several periods while the photoelastic model is undergoing steady state cyclic loading. The fringe pattern depicts amplitudes of the oscillating stresses according to the zeroth order Bessel function. These properties permit the determination of a time-averaged cyclic stress-optic law. It is also possible to use the method to determine time-averaged isoclinics. The method has great potentiality in the study of in-plane vibrations. Author (GRA)

N77-21493# National Bureau of Standards, Washington, D. C.
PROOF TESTING: THE EFFECTS OF SLOW CRACK GROWTH Final Report
A. G. Evans and E. R. Fuller 1975 11 p refs Repr. from Mater. Sci. and Eng., v. 19, no. 1, 1975 p 69-77
(PB-260637/4) Avail: NTIS HC A02/MF A01 CSCL 11B

When slow crack growth in brittle materials occurs during proof testing, the extent of the crack growth while unloading from the proof stress has a substantial effect on the minimum predicted in-service failure time. It is essential that this crack growth is minimized to achieve effective failure prediction. Analyses are presented which show that the detrimental effects can be negated by environmental control during proof testing and/or rapid unloading from the proof stress. The requisite combination of unloading rate and environmental control is determined separately for each system. GRA

N77-21494# National Bureau of Standards, Washington, D. C. Engineering Mechanics Section.
RATIONAL BASIS AND NEW METHODS FOR PROPORTIONAL LIMIT, MACHINE STIFFNESS, CRITICAL STRESS INTENSITY, AND CRACK VELOCITY MEASUREMENTS

1976 15 p refs Repr. from Proc. 28th Ann. Meeting, Am. Soc. for Testing and Mater., Montreal, Canada, 22-27 Jun. 1975, ASTM-STP-608, Recent Develop. in Mechan. Testing, 1976 p 20-44
(PB-260834/7) Avail: NTIS HC A02/MF A01 CSCL 11F

The advantages of these techniques over those in practice are discussed. The rational basis of these techniques is a rate analysis of the tensile test. A partial list of results includes: (1) machine stiffness measurement method applicable of work hardening materials, presented for constant crosshead velocity, constant load rate, and constant strain rate type tests. (2) proportional limit determination method for elastic deformation or crack extension critical stress intensity, applicable in uniaxial or multiaxial modes with a special variant useful in hostile environments (temperature, pressure, radiation, chemicals) in which a sample strain gage is not used, and (3) a technique to monitor machine relaxation during crack velocity measurements. GRA

N77-21495# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.

LARGE DEFLECTION ANALYSIS OF THIN ELASTIC STRUCTURES BY THE ASSUMED STRESS HYBRID FINITE ELEMENT METHOD Final Report

Peter L. Boland Oct. 1975 311 p refs
(Contract F44620-72-C-0018; AF Proj. 9782)
(AD-A031279; ASRL-TR-170-4; AFOSR-76-1111TR) Avail: NTIS HC A14/MF A01 CSCL 20/11

Two models for analyzing the large deflection, linear elastic, static behavior of structures have been developed. They are the consistent and inconsistent assumed stress hybrid finite element models. The consistent model satisfies the entire stress equilibrium equation while the inconsistent model satisfies only the linear portion of this equation. These models are consistently derived from the Principle of Virtual Work for two separate coordinate frames: a stationary system and a convected (moving), updated system. Throughout the development 'correction' terms are maintained in all the functionals to minimize the approximate solution drifting away from the true solution. These correction terms correspond to checks on the stress equilibrium and compatibility in the reference state. The former check is recast into a more convenient form, for these models, than is usually used. Using a tangent stiffness approach (updated at every solution step) various incremental and incremental-iterative solution procedures are used. When used the check conditions are represented as equivalent loads. Careful attention is given to properly define various coordinate systems and reference frames. In conjunction with this the various definitions of stress and strain are discussed. Energy and work terms consistent with each system are considered in detail. The proper statements of the Principle of Virtual Work are defined. GRA

N77-21496# California Univ., Berkeley. Dept. of Mechanical Engineering.

SOME CONSTITUTIVE RESTRICTIONS IN PLASTICITY

P. M. Naghdi Aug. 1976 18 p refs
(Contract N00014-75-C-0148; NR Proj. 064-436)
(AD-A031321; AM-76-5) Avail: NTIS HC A02/MF A01 CSCL 20/11

An account is given here of some recent results in the mechanical theory of finitely deformed elastic-plastic materials, which are chiefly concerned with some constitutive restrictions. These restrictions are discussed both in the context of the general theory and for special materials. The development presented includes also a discussion of an alternative formulation of plasticity theory relative to loading surfaces in strain space and elaborates on its significance, as well as several of its features.
Author (GRA)

N77-21497# California Univ., Berkeley. Dept of Mechanical Engineering.

LARGE DEFORMATION POSSIBLE IN EVERY ISOTROPIC ELASTIC MEMBRANE

P. M. Naghdi and P. Y. Tang Sep. 1976 87 p refs
(Contract N00014-75-C-0148; NR Proj. 064-436)
(AD-A031344; AM-76-6) Avail: NTIS HC A05/MF A01 CSCL 20/11

This paper is concerned with static solutions of finitely deformed elastic membranes regarded as thin shells. It deals with deformations that can be maintained, in the absence of body force, in every isotropic elastic membrane by the application of edge loads and/or uniform normal surface loads on the major surfaces of the thin shell-like body. The solutions, which are valid for both compressible and incompressible materials, are obtained with the use of a strain energy response function which depends on the metric tensor of the membrane in its deformed configuration. The main results are summarized by several theorems and their corollaries in accordance with three mutually exclusive cases for which the initial undeformed surface of the membrane (which may be a sector of a complete or closed surface) is, respectively, developable, spherical and a surface of variable Gaussian curvature satisfying certain differential criteria. GRA

N77-21498# Oakland Univ., Rochester, Mich. School of Engineering.

TIME-AVERAGED SHADOW-MOIRE METHOD FOR STUDYING VIBRATIONS

Y. Y. Hung, C. Y. Liang, J. D. Houanesian, and A. J. Durelli Nov. 1976 27 p refs
(Contract N00014-76-C-0487; Grant NSF ENG-76-08751)
(AD-A032081) Avail: NTIS HC A03/MF A01 CSCL 20/11

A time-averaged shadow-moire method is presented which permits the determination of the amplitude distribution of the deflection of a plate in steady state vibration. No stroboscope is required and the recording is done statically. The method is less sensitive than holographic methods and is therefore suitable for studying relatively large amplitudes. Author (GRA)

N77-21499# Massachusetts Inst. of Tech., Cambridge.

USE OF THE HYBRID-STRESS FINITE-ELEMENT MODEL FOR THE STATIC AND DYNAMIC ANALYSIS OF MULTILAYER COMPOSITE PLATES AND SHELLS Final Report

Robert L. Spilker, Oscar Orringer, Elmer A. Witmer, Samuel Verbiese, and Susan E. French Sep. 1976 221 p refs
(Contract DAAG46-75-C-0055; DA Proj. 1W3-62306-AH-72)
(AD-A031361; ASRL-TR-181-2) Avail: NTIS HC A10/MF A01 CSCL 20/11

This report presents the results of an investigation into the formulation and application of assumed-stress hybrid finite-elements for bending of multilayer laminated plates and shells. Two families of hybrid-stress-based multilayer plate elements are considered; these elements are denoted as thick plate and moderately-thick plate elements. In the development of the thick plate elements, transverse shear deformation effects are included by allowing lines normal to the plate midsurface in the undeformed state to be piecewise linear from layer to layer in the deformed state. Transverse shear deformation effects are included in an average sense in the moderately-thick plate element family by assuming that straight lines normal to the plate midsurface prior to deformation remain straight but not necessarily normal to the plate midsurface after deformation. Comparison of the results obtained by using the thick plate and moderately-thick plate elements with independent analytical results shows that the moderately-thick plate elements are more efficient and practical for the analysis of multilayer structures having a large number of elastically dissimilar layers. GRA

N77-21500# Weidlinger Associates, New York.

ELASTO-PLASTIC BEHAVIOR OF PLATES AND SHELLS

M. P. Bieniek and J. R. Funaro Mar. 1976 35 p refs
(Contract DNA001-76-C-0125; DNA Proj. NWED-QAXSC060)
(AD-A031408; DNA-3954T) Avail: NTIS HC A03/MF A01 CSCL 20/11

For an isotropic solid shell, a yield condition, a strain-hardening rule, and a flow rule have been formulated in terms of the membrane forces and bending moments and the strains and curvatures of the middle surface. The results of the proposed theory are compared to the results of the through-the-thickness integration of the stress-strain relations of the material.
Author (GRA)

42 GEOSCIENCES (GENERAL)

N77-21501# Energy Research and Development Administration, Washington, D.C. Div. of Physical Research.
SUMMARY OUTLINE OF ERDA GEOSCIENCES AND GEOSCIENCE-RELATED RESEARCH
Aug. 1976 71 p
(ERDA-76/114) Avail: NTIS HC A04/MF A01

Principal areas of interest include, in the field of atmospheric sciences: studies of the troposphere, particle formation, particulate matter, behavior of aerosols and gases, atmospheric transport and diffusion of fossil fuel pollutants, radionuclides, radionuclide global distribution patterns, nuclear emergency response systems, precipitation scavenging and dry deposition, regional relationships between pollutant sources and ambient atmospheric concentrations; and oceanographic studies of radioactivity that may be directly added to the environment from waste disposal activities and reactor operations or indirectly from nuclear explosions and transportation, the source term characterization, transport, fate, and effects of these pollutants in the marine environment; and studies of thermal effects on biological systems, mixing and circulation of water, distribution of radionuclides in ocean waters and sediments, and geochronology. A summary outline of the research programs is presented. ERA

N77-21502# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data Service.
IFYGL PHYSICAL DATA COLLECTION SYSTEM: DESCRIPTION OF ARCHIVED DATA
Jack Foreman Sep. 1976 180 p refs
(PB-261829/6; NOAA-TR-EDS-15; NOAA-76101304) Avail: NTIS HC A09/MF A01 CSCL 04B

The data obtained by the Physical Data Collection System, a network of towers, buoys, and land stations used during the International Field Year for the Great Lakes (IFYGL) for limnological and meteorological measurements on Lake Ontario are described. Sensors used, calibration procedures, and data processing techniques are discussed, and inventories are given of the archived data. GRA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N77-21503*# Northern Prairie Wildlife Research Center, Jamestown, N. Dak.
APPLICATION OF LANDSAT SYSTEM FOR IMPROVING METHODOLOGY FOR INVENTORY AND CLASSIFICATION OF WETLANDS Progress Report, 1 Jan. - 31 Mar. 1977
David S. Gilmer, Principal Investigator and Edgar A. Work, Jr. 18 Apr. 1977 7 p refs ERTS
(NASA Order S-54049-A)
(E77-10136; NASA-CR-152630) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. LANDSAT and aircraft data were compared for differences in absolute numbers of water bodies in the two data sets. This comparison was done using a linear regression analysis. The coefficients of determination were 0.65 and 0.74 for data of May and July, respectively. Standard statistical procedures were used to adjust the LANDSAT pond counts to actual pond numbers based on regression relationships.

N77-21504*# Zurich Univ. (Switzerland). Dept. of Geography.
SNOW MAPPING AND LAND USE STUDIES IN SWITZERLAND Final Report
Harold Haefner, Principal Investigator Jan. 1977 53 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10137; NASA-CR-152631) Avail: NTIS HC A04/MF A01 CSCL 08L

The author has identified the following significant results. A system was developed for operational snow and land use mapping, based on a supervised classification method using various classification algorithms and representation of the results in maplike form on color film with a photomation system. Land use mapping, under European conditions, was achieved with a stepwise linear discriminant analysis by using additional ratio variables. On fall images, signatures of built-up areas were often not separable from wetlands. Two different methods were tested to correlate the size of settlements and the population with an accuracy for the densely populated Swiss Plateau between +2 or -12%.

N77-21505*# Delaware Univ., Newark. Center for Remote Sensing.
VARIABILITY OF WETLAND REFLECTANCE AND ITS EFFECT ON AUTOMATIC CATEGORIZATION OF SATELLITE IMAGERY
V. Klemas, Principal Investigator and D. Bartlett 10 Jan. 1977 2 p ERTS
(Contract NAS5-20983)
(E77-10139; NASA-CR-152633) Avail: NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. Land cover categorization of data from the same overpass in four test wetland areas was carried out using a four category classification system. The tests indicate that training data based on in situ reflectance measurements and atmospheric correction of LANDSAT data can produce comparable accuracy of categorization to that achieved using more than four wetlands cover categories (salt marsh cordgrass, salt hay, unvegetated, and water tidal flat). These data produced overall classification accuracies of 85% by conventional and relative radiance training and 81% by use of in situ measurements. Overall mapping accuracies were 76% and 72% respectively.

N77-21506*# Delaware Univ., Newark. Center for Remote Sensing.
APPLICATION OF LANDSAT-2 TO THE MANAGEMENT OF DELAWARE'S MARINE AND WETLAND RESOURCES Progress Report, Jan. - Mar. 1977
V. Klemas, Principal Investigator, D. Bartlett, W. Philpot, and G. Davis 10 Apr. 1977 5 p refs ERTS
(Contract NAS5-20983)
(E77-10140; NASA-CR-152634) Avail: NTIS HC A02/MF A01 CSCL 08J

The author has identified the following significant results. The problem of remote sensing of suspended matter in water was analyzed in terms of the single scattering albedo, and a semiempirical relationship between satellite radiance measurements and the concentration of suspended matter in the water was developed. The relationship was tested using data from the 7 July 1973 LANDSAT overpass of Delaware Bay with good results.

N77-21507*# Science and Technology Agency, Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN Quarterly Progress Report, Jan. - Mar. 1977
Takakazu Maruyasu, Principal Investigator 31 Mar. 1977 1 p Sponsored by NASA ERTS
(E77-10141; NASA-CR-152635) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N77-21508*# California Univ., Berkeley. Space Sciences Lab.
AN INTEGRATED STUDY OF EARTH RESOURCES IN THE STATE OF CALIFORNIA USING REMOTE SENSING TECHNIQUES Semiannual Progress Report
Robert N. Colwell, Principal Investigator 31 Dec. 1976 279 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-05-003-404)

(E77-10142; NASA-CR-152636; SSL-Ser-18-Issue-5) Avail: NTIS HC A13/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N77-21509*# Technische Universitaet, Clausthal-Zellerfeld (West Germany). Geologisches Institut.

MAPPING OF LITHOLOGICAL UNITS, STRUCTURAL UNITS AND SURFACE DRAINAGE USING SKYLAB DATA Final Report, 1974 - 1975

P. Kronberg, Principal Investigator Dec. 1975 15 p Sponsored by NASA Original contains color illustrations EREP

(E77-10143; NASA-CR-151212) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N77-21510*# Delaware Univ., Newark. Center for Remote Sensing.

DISTRIBUTION AND CONCENTRATION OF SUSPENDED MATTER IN DELAWARE BAY

V. Klemas, Principal Investigator and W. Philpot 10 Apr. 1977 2 p ERTS

(Contract NAS5-20983)

(E77-10144; NASA-CR-152637) Avail: NTIS HC A02/MF A01 CSCL 08J

The author has identified the following significant results. The problem of remote sensing of suspended matter in water was analyzed in terms of the single-scattering albedo, and a semiempirical relationship between satellite radiance measurements and the concentration of suspended matter in the water was developed. The relationship was tested using data from the 7 July 1973 LANDSAT overpass of Delaware Bay with good results. Suspended sediment concentration maps for the entire Delaware Bay were prepared using radiance values extracted from LANDSAT MSS imagery and correlating them with ground truth samples collected from boats and helicopter.

N77-21511*# Ministry of Construction, Seoul (South Korea).

LAND USE SURVEY AND MAPPING, AND WATER RESOURCES INVESTIGATION IN KOREA Quarterly Report

Jae Hwa Choi, Principal Investigator 31 Mar. 1977 3 p Sponsored by NASA ERTS

(E77-10145; NASA-CR-152638) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N77-21512*# National Marine Fisheries Service, Bay Saint Louis, Miss.

LANDSAT MENHADEN AND THREAD HERRING RESOURCES INVESTIGATION, GULF OF MEXICO Progress Report, 1 Nov. 1976 - 31 Jan. 1977

Kenneth Savastano, Principal Investigator, Andrew J. Kemmerer, Thomas Leming, Hillman Holley, and Kenneth Faller (NASA. Slidell Computer Complex, Slidell, La.) Feb. 1977 38 p ERTS

(NASA Order S-54114)

(E77-10146; NASA-CR-152639; SEFC-Contrib-480; MARMAP-Contrib-136; Rept-7) Avail: NTIS HC A03/MF A01 CSCL 08A

The author has identified the following significant results. The most significant achievement thus far includes the successful charting of high probability fishing areas from LANDSAT MSS data and the successful simulation of an operational satellite system to provide tactical information for the commercial harvest of menhaden.

N77-21513*# Stanford Univ., Calif. Dept. of Applied Earth Sciences.

SIMULTANEOUS USE OF LANDSAT DIGITAL DATA WITH THAT OF GEOPHYSICAL AND GEOLOGICAL SURVEYS IN GEOMATHEMATICAL MODELLING FOR MINERAL EXPLORATION PREDICTION Progress Report, 2 Nov. 1976 - 2 Apr. 1977

A. A. Missallati and R. J. P. Lyon, Principal Investigator 2 Apr. 1977 9 p refs Sponsored by NASA ERTS

(E77-10147; NASA-CR-15264) Avail: NTIS HC A02/MF A01 CSCL 08G

The author has identified the following significant results. A computer test file was created for the analysis of two rows in the pilot area. Data were organized into two groups with and without radioactivity above 1200 counts. The first 42 samples corresponded to the geographic cells which were anomalous, and the rest of the samples (70) were without anomalous values. Output analysis shows that all samples were properly classified.

N77-21514*# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

LAND USE AND POLLUTION PATTERNS ON THE GREAT LAKES Final Report, Apr. 1972 - Mar. 1975

R. K. Haugen, Principal Investigator, H. L. McKim, and T. L. Marlar Mar. 1975 258 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S.D. 57198 ERTS

(E77-10148; NASA-CR-152641) Avail: NTIS HC A12/MF A01 CSCL 08B

The author has identified the following significant results. The final mapping of the large watersheds of the Manitowoc and the Oconto was done using the 25% sampling approach. Comparisons were made with earlier strip mapping efforts of the Oconto and Manitowoc watersheds. Regional differences were noted. Strip mapping of the Oconto resulted in overestimation of the amount of agricultural land compared to the random sampling method. For the Manitowoc, the strip mapping approach produced a slight underestimate of agricultural land, and an overestimate of the forest category.

N77-21515*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT: US STANDARD CATALOG, 1 JANUARY 1977 THROUGH 31 JANUARY 1977

31 Jan. 1977 57 p refs

(NASA-TM-X-74614; NTISUB/C/138-001; GSFC/LU-C/001) Avail: NTIS HC A04/MF A01 CSCL 05B

The U.S. Standard Catalog lists U.S. imagery acquired by LANDSAT 1 and LANDSAT 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N77-21516*# Naval Research Lab., Washington, D. C.

MEASUREMENTS OF FAR-ULTRAVIOLET PHOTOGRAPHS FROM SKYLAB 4 AND APOLLO 6 Final Report

Thornton Page 8 Mar. 1977 5 p refs

(NASA Order T-9602-B)

(NASA-CR-151242) Avail: NTIS HC A02/MF A01 CSCL 14E

Over 700 far UV photos were obtained with the S201 electrographic camera on Skylab 4 (27 Nov. 1973 - 28 Jan. 1974) and from the Apollo-16 lunar site (21 - 23 Apr. 1972). The Lyman-alpha geocorona was found to fit R. R. Meier's model, and the tropical airglow belts were measured quantitatively. The history of Comet Kohoutek's Ly-alpha halo (and lack of an oxygen halo) was followed from 32 days before to 13 days after perihelion passage, and fitted to a model of hydrogen production from the comet. Far UV emissions from the Large Magellanic Cloud were also measured quantitatively and compared with ground-based measurements of stellar associations and nebulae. Computer programs were developed to contour the densities measured by microphotometer on the original film and to locate and sum density-volumes in each starlike image. In addition, thousands of stars were identified and their far UV flux measured in two band-passes (1050 - 1600 A, 1250 - 1600 A). Author

N77-21517*# California Univ., Berkeley. Space Sciences Lab.

FORESTRY APPLICATIONS PROJECT/TIMBER RESOURCE. SAM HOUSTON NATIONAL FOREST INVENTORY AND DEVELOPMENT OF A SURVEY PLANNING MODEL Final Report, 15 Nov. 1974 - 31 Jul. 1976

Robert N. Colwell 14 Jul. 1976 142 p refs

(Contract NAS9-14452)

(NASA-CR-151243; SSL-Ser-17-Issue-55) Avail: NTIS

HC A07/MF A01 CSCL 02F

The Forestry Applications Project has been directed towards solving the problem of meeting informational needs of the resource managers utilizing remote sensing data sources including satellite data, conventional aerial photography, and direct measurement on the ground in such combinations as needed to best achieve these goals. It is recognized that sampling plays an important role in generating relevant information for managing large geographic populations. The central problem, therefore, is to define the kind and amount of sampling and the place of remote sensing data sources in that sampling system to do the best possible job of meeting the manager's informational needs. Author

N77-21518*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

APPLICATION OF REMOTE THERMAL SCANNING TO THE NASA ENERGY CONSERVATION PROGRAM

Robert L. Bowman and John R. Jack Jan. 1977 25 p refs Original contains color illustrations

(NASA-TM-X-73570; E-9017) Avail: NTIS HC A02/MF A01 CSCL 08B

Airborne thermal scans of all NASA centers were made during 1975 and 1976. The remotely sensed data were used to identify a variety of heat losses, including those from building roofs and central heating system distribution lines. Thermal imagery from several NASA centers is presented to demonstrate the capability of detecting these heat losses remotely. Many heat loss areas located by the scan data were verified by ground surveys. At this point, at least for such energy-intensive areas, thermal scanning is an excellent means of detecting many possible energy losses. Author

N77-21519*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

MIDAS PROTOTYPE MULTISPECTRAL INTERACTIVE DIGITAL ANALYSIS SYSTEM FOR LARGE AREA EARTH RESOURCES SURVEYS. VOLUME 2: CHARGE COUPLED DEVICE INVESTIGATION Final Report, Oct. 1975 - Jan. 1976

F. Kriegler, R. Marshall, and S. Sternberg Aug. 1976 48 p refs 2 Vol.

(Contract NAS1-13128)

(NASA-CR-145166; ERIM-108800-54-F) Avail: NTIS HC A03/MF A01 CSCL 05B

MIDAS is a third-generation, fast, low cost, multispectral recognition system able to keep pace with the large quantity and high rates of data acquisition from large regions with present and projected sensors. MIDAS, for example, can process a complete ERTS frame in forty seconds and provide a color map of sixteen constituent categories in a few minutes. A principal objective of the MIDAS Program is to provide a system well interfaced with the human operator and thus to obtain large overall reductions in turn-around time and significant gains in throughput. The need for advanced onboard spacecraft processing of remotely sensed data is stated and approaches to this problem are described which are feasible through the use of charge coupled devices. Tentative mechanizations for the required processing operations are given in large block form. These initial designs can serve as a guide to circuit/system designers. Author

N77-21520*# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.

GEOMETRIC ASSESSMENT OF IMAGE QUALITY USING DIGITAL IMAGE REGISTRATION TECHNIQUES Final Report

Glenn E. Tisdale Aug. 1976 64 p

(Contract NAS5-20947)

(NASA-CR-152481) Avail: NTIS HC A04/MF A01 CSCL 05B

Image registration techniques were developed to perform a geometric quality assessment of multispectral and multitemporal image pairs. Based upon LANDSAT tapes, accuracies to a small fraction of a pixel were demonstrated. Because it is insensitive to the choice of registration areas, the technique is well suited to performance in an automatic system. It may be implemented at megapixel-per-second rates using a commercial minicomputer in combination with a special purpose digital preprocessor. Author

N77-21521*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

A LASER TECHNIQUE FOR CHARACTERIZING THE GEOMETRY OF PLANT CANOPIES

V. C. Vanderbilt, L. F. Silva, and M. E. Bauer Jan. 1977 77 p refs

(Contract NAS9-14016; NAS9-14970)

(NASA-CR-151326; LARS-IN-120776) Avail: NTIS HC A05/MF A01 CSCL 20E

The interception of solar power by the canopy is investigated as a function of solar zenith angle (time), component of the canopy, and depth into the canopy. The projected foliage area, cumulative leaf area, and view factors within the canopy are examined as a function of the same parameters. Two systems are proposed that are capable of describing the geometrical aspects of a vegetative canopy and of operation in an automatic mode. Either system would provide sufficient data to yield a numerical map of the foliage area in the canopy. Both systems would involve the collection of large data sets in a short time period using minimal manpower. Author

N77-21522*# Ecosystems International, Inc., Gambrills, Md.

THE APPLICATION OF REMOTE SENSING TO THE DEVELOPMENT AND FORMULATION OF HYDROLOGIC PLANNING MODELS: EXECUTIVE SUMMARY

Peter A. Castruccio, Harry L. Loats, Jr., and Thomas R. Fowler 28 Feb. 1977 20 p

(Contract NAS8-30539)

(NASA-CR-150235; ECO-77-C-2-1; ECO-77-Exec; C-2-1-Exec) Avail: NTIS HC A02/MF A01 CSCL 08H

Methods for the reduction of remotely sensed data and its application in hydrologic land use assessment, surface water inventory, and soil property studies are presented. LANDSAT data is used to provide quantitative parameters and coefficients to construct watershed transfer functions for a hydrologic planning model aimed at estimating peak outflow from rainfall inputs. A.R.H.

N77-21523*# Ecosystems International, Inc., Gambrills, Md.

THE APPLICATION OF REMOTE SENSING TO THE DEVELOPMENT AND FORMULATION OF HYDROLOGIC PLANNING MODELS Final Report

Thomas R. Fowler, Peter A. Castruccio, and Harry L. Loats, Jr. 28 Feb. 1977 107 p refs

(Contract NAS8-30539)

(NASA-CR-150236; ECO-77; C-2-1) Avail: NTIS HC A06/MF A01 CSCL 08H

The development of a remote sensing model and its efficiency in determining parameters of hydrologic models are reviewed. Procedures for extracting hydrologic data from LANDSAT imagery, and the visual analysis of composite imagery are presented. A hydrologic planning model is developed and applied to determine seasonal variations in watershed conditions. The transfer of this technology to a user community and contract arrangements are discussed. A.R.H.

N77-21524*# General Electric Co., Philadelphia, Pa. Space Div.

LANDSAT D: X-BAND ANALYSIS STUDY Final Report

L. Alexander, R. Fischer, R. Milton, J. Seitner, D. Sliwowicz, and R. Spencer 15 Apr. 1977 35 p refs

(Contract NAS5-23412)

(NASA-CR-152483; Doc-77SDS4223) Avail: NTIS HC A03/MF A01 CSCL 20N

The effects of the use of an X-band carrier frequency on the transmission link margins and on the affected ground station equipment are investigated. The specific effects of the X-band carrier frequency allocation on the link margin are detailed. This includes an examination of a Local User Terminal's (LUT) coverage circle radius requirements, detailed elements of the link calculation, and specific spacecraft and ground configurations that would satisfy the link requirements. The requirements that spacecraft signal acquisition and tracking place on the front-end of the ground station equipment are also examined. The availability of the required ground station equipment and representative costs for these items are included. The costs considered shall be both for procurement of a new ground station (front-end only) and for modification of an existing S-band station to X-band. Author

N77-21525*# General Electric Co., Philadelphia, Pa. Space Div.

LANDSAT D: APPLICATIONS DEVELOPMENT LABORATORY STUDY Final Report

L. Alexander, D. Dietrich, R. Fries, V. J. Kharkanis, N. Portner, and D. Smith 15 Apr. 1977 85 p

(Contract NAS5-23412)

(NASA-CR-152484; Doc-77SDS4224) Avail: NTIS HC A05/MF A01 CSCL 02C

As the Earth Resources Program has matured through the LANDSAT spacecraft it has begun the transition from an experimental research activity to a sound demonstration of proven utility. This important transition will be complete with the LANDSAT D system which incorporates several key improvements over the current system. These improvements, based on experience with the existing LANDSATs, will provide new capabilities in the spacecraft, the sensor, the ground system, and the overall system design. Author

N77-21526*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

REMOTE SENSING: SNOW MONITORING TOOL FOR TODAY AND TOMORROW

Albert Rango Mar. 1977 12 p refs Presented at Western Snow Conf., Albuquerque, N. Mex., 18-21 Apr. 1977

(NASA-TM-X-71287; X-913-77-57) Avail: NTIS HC A02/MF A01 CSCL 08L

Various types of remote sensing are now available or will be in the future for snowpack monitoring. Aircraft reconnaissance is now used in a conventional manner by various water resources agencies to obtain information on snowlines, depth, and melting of the snowpack for forecasting purposes. The use of earth resources satellites for mapping snowcovered area, snowlines, and changes in snowcover during the spring has increased during the last five years. Gamma ray aircraft flights, although confined to an extremely low altitude, provide a means for obtaining valuable information on snow water equivalent. The most recently developed remote sensing technology for snow, namely, microwave monitoring, has provided initial results that may eventually allow us to infer snow water equivalent or depth, snow wetness, and the hydrologic condition of the underlying soil. Author

N77-21527# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).

STUDY OF THE WESTERN LIMIT OF THE SUBTROPICAL CONVERGENCE IN THE SOUTH ATLANTIC OCEAN USING SATELLITE NIMBUS V, AND OCEANOGRAPHIC DATA FOR THE PERIOD OF 1972 TO 1973

Tseng Yun Chi Sep. 1976 100 p refs In PORTUGUESE; ENGLISH summary

Avail: NTIS HC A05/MF A01

The thermal discontinuity of the ocean was studied, utilizing the Temperature Humidity Infrared Radiometer (THIR) of NIMBUS V and historical oceanographic data. Seventy five THIR images were visually interpreted and some of them with the Image-100. The main study was done by superposition of the detected fronts, on surface temperature and salinity charts. These results showed the great potentiality of satellite data to study surface thermal structures, surface currents, and oceanic fisheries. Author

N77-21528*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN ESTIMATE OF FIELD SIZE DISTRIBUTIONS FOR SELECTED SITES IN THE MAJOR GRAIN PRODUCING COUNTRIES

Melvin H. Podwysocki Apr. 1977 39 p

(NASA-TM-X-71288; X-923-76-93) Avail: NTIS HC A03/MF A01 CSCL 02C

The field size distributions for the major grain producing countries of the World were estimated. LANDSAT-1 and 2 images were evaluated for two areas each in the United States, People's Republic of China, and the USSR. One scene each was evaluated for France, Canada, and India. Grid sampling was done for representative sub-samples of each image, measuring the long and short axes of each field; area was then calculated. Each of the resulting data sets was computer analyzed for their frequency distributions. Nearly all frequency distributions were highly peaked and skewed (shifted) towards small values, approaching that of either a Poisson or log-normal distribution. The data were normalized by a log transformation, creating a Gaussian distribution which has moments readily interpretable and useful for estimating the total population of fields. Resultant predictors of the field size estimates are discussed. Author

N77-21529*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DISCRIMINATION OF ROCK AND SOIL TYPES BY DIGITAL ANALYSIS OF LANDSAT DATA

Melvin H. Podwysocki, Fred J. Gunther (Computer Sci. Corp., Silver Spring, Md.), and Herbert W. Blodget Jan. 1977 44 p refs Submitted for publication

(NASA-TM-X-71290; X-923-77-17) Avail: NTIS CSCL 08G

Principal component analysis, followed by contrast enhancement of the transformed data, provided good separation of the various lithologies of tested terranes. Canonical analysis, using training area statistics developed on the four LANDSAT MSS bands, provided black and white images and color composites with greater spectral separation for some rock units but not for others. All techniques allowed the production of a geologic map with more detail than some reconnaissance maps. Canonical analysis produced a more detailed picture than the more general principal components, band rationing or contrast enhancement procedures but involved much more work. Exact results appear to be scene-dependent. Author

N77-21530*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MEAN SEA LEVEL DETERMINATION FROM SATELLITE ALTIMETRY

W. D. Kahn, B. B. Agrawal (Computer Sci. Corp.), and R. D. Brown (Computer Sci. Corp.) Mar. 1977 28 p refs Submitted for publication

(NASA-TM-X-71298; X-921-77-41) Avail: NTIS HC A03/MF A01 CSCL 05B

The primary experiment on the Geodynamics Experimental Ocean Satellite-3 (GEOS-3) is the radar altimeter. This experiment's major objective is to demonstrate the utility of measuring the geometry of the ocean surface, i.e. the geoid. Results obtained from this experiment so far indicate that the planned objectives of measuring the topography of the ocean surface with an absolute accuracy of + or - 5 meters can be met and perhaps exceeded. The GEOS-3 satellite altimeter measurements have an instrument precision in the range of + or - 25 cm to + or - 50 cm when the altimeter is operating in the short pulse mode. Author

N77-21531# Indian Space Research Organization, Trivandrum.

BIBLIOGRAPHY ON REMOTE SENSING

K. Rajarajeswari, comp. 31 Mar. 1977 246 p refs

Avail: NTIS HC A11/MF A01

An index to 2,667 documents on remote sensing cited in Scientific and Technical Aerospace Reports and International Aerospace Abstracts from 1970 to 1975 is presented. Entries are arranged alphabetically by author or title and include report number and document source. An alphabetical keyword index and report number index are also provided. Author

N77-21532# California Univ., Berkeley. Lawrence Berkeley Lab. Div. of Energy and Environment.

METHODS FOR GEOTHERMAL RESERVOIR DETECTION EMPHASIZING SUBMERGED ENVIRONMENTS

Charles W. Case and Pat Wilde 21 May 1976 77 p refs

(Contract W-7405-eng-48)

(LBL-4495) Avail: NTIS HC A05/MF A01

A logical progression of specific geologic, geochemical, and geophysical exploration techniques for detecting geothermal reservoirs in various geologic environments with emphasis on submerged lands was developed. Various exploration techniques which can be used to develop specific information in geothermal areas were discussed. The specific geologic situation will control the exploration criterion to be used for reservoir detection. General guidelines are established which may be of use in evaluating such a program, but the optimum approach will vary with each situation. ERA

N77-21533# Massachusetts Inst. of Tech., Cambridge.

SEISMOLOGICAL INVESTIGATION OF CRACK FORMA-

TION IN HYDRAULIC ROCK FRACTURING EXPERIMENTS AND IN NATURAL GEOTHERMAL ENVIRONMENTS
Progress Report, 1 Sep. 1975 - 31 Aug. 1976
Keiiti Aki Sep. 1976 36 p refs
(Contract E(11-1)-2534)
(COO-2534-2) Avail: NTIS HC A03/MF A01

A variety of seismological methods is being developed for determining the structure of a geothermal energy source region. Seismic signals generated in the source region are utilized by interpreting them in terms of the parameters of a seismic source model. For example, using a fluid-filled tensile crack driven by excess pressure in fluid as a model of volcanic tremor, formulas are derived which relate seismic observations with model parameters, and the formulas were successfully applied to an actual eruption in Kilauea, giving a new insight to the magma transport in a volcano. Theoretical work is continued on the diffraction of seismic waves by a crack, and it was demonstrated that the size and location of a crack can be well determined by particle motion near the crack at various frequencies. The method was applied to Kilauea Iki and the location of the magma lens was found to be in agreement with that estimated by another method. ERA

N77-21534# Northeastern Research Foundation, Inc., West Boothbay Harbor, Maine. Bigelow Lab. for Ocean Studies.
INTERRELATIONSHIP BETWEEN CERTAIN HYDROGRAPHIC FEATURES ASSOCIATED WITH CURRENTS AND PRIMARY PRODUCTION Annual Progress Report, 1 Aug. 1975 - 31 Jul. 1976
C. S. Yentsch 1976 9 p
(Contract E(11-1)-2538)
(COO-2538-15) Avail: NTIS HC A02/MF A01

The application of biochemical tests to implicate specific limiting factors has shown that for most of the growing season (spring through fall), nitrogen limits phytoplankton growth and more specifically controls the size of the blooms of phytoplankton in New England coastal waters. The seasonal sequence of phytoplankton appears to be a composite of two major blooms and numerous smaller outbursts of growth. The latter seem to be related to vertical turbulence which re-enriches the euphotic zone with nutrients. The cause or source of this turbulance is not clearly identified. ERA

N77-21535# Oak Ridge National Lab., Tenn.
DIGITAL GEOGRAPHIC DATA WITH GRIDOT: A GENERALIZED PROGRAM FOR DRAWING OVERLAY GRIDS IN VARIOUS MAP PROJECTIONS
R. G. Edwards and R. C. Durfee Sep. 1976 127 p refs Sponsored in part by NSF
(Contract W-7405-eng-26)
(ORNL/RUS-17) Avail: NTIS HC A07/MF A01

The GRIDOT computer program draws overlay grids on a Calcomp plotter for use in digitizing information from maps, rectified aerial photographs, and other sources of spatially distributed data related to regional environmental problems. The options of the program facilitate use of the overlays with standard maps and map projections of the continental United States. The overlay grid is defined as a latitude-longitude grid (geodetic grid), a universal transverse mercator grid, or one of the standard state plane coordinate system grids. ERA

N77-21536# World Meteorological Organization, Geneva (Switzerland).
FIFTH SESSION OF THE COMMISSION FOR HYDROLOGY Abriged Final Report
1976 159 p Conf. held at Ottawa, 5-16 Jul. 1976
(WMO-453; ISBN-92-63-10453-0) Avail: NTIS HC A08/MF A01

Following a general summary of the session, resolutions and recommendations of the session on all aspects of hydrology are presented. Annexes to the resolutions give the terms of reference of the various working groups. Author (ESA)

N77-21537# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.
REFLECTION SPECTRA OF SOME SOIL SAMPLES IN THE NETHERLANDS, DETERMINED WITH THE NIWARS FIELD SPECTROMETER [REFLECTIESPECTRA VAN ENIGE NEDERLANDSE BODEMMONSTERS BEPAALD MET DE NIWARS - VELDSPECTROMETER]
A. R. P. Janse and N. J. J. Bunnik Jul. 1974 32 p refs In DUTCH
(NIWARS-Publ-18) Avail: NTIS HC A03/MF A01

Spectral reflection of different soil samples was investigated using the NIWARS visible light and infrared fieldspectrometer. The effect of the aggregate size was not significant for samples with a fine texture. The influence of moisture content was appreciable both in visible light and in the infrared. The reflection spectrum method was found to be useful for the determination of soil characteristics. ESA

N77-21538# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
OBSERVATION RASTER OF A GIVEN AREA BY A REMOTE SENSING SATELLITE WITH SCAN SENSOR. DESCRIPTION OF THE SCANSI PROGRAM [BEOBACHTUNGSRASTER EINES VORGEGEBENEN ORTES DURCH EINEN ERDERKUNDIGUNGSSATELLITEN MIT SCAN - SENSOR. BESCHREIBUNG DES PROGRAMMS SCANSI]
E. F. Jochim and A. Pietrass 11 Nov. 1976 26 p ref In GERMAN
(DLR-IB-552-76/14) Avail: NTIS HC A03/MF A01

The SCANSI computer program was developed to investigate the observation raster of a given location attained by a remote sensing satellite with sensor scanning perpendicular to the orbital plane. The satellite motion is modeled according to Kepler with superposed secular perturbations. The output consists of diagrams showing when and how far a given location on the earth's surface falls within the scan range of the satellite. Examples of the output are given for the planned POMS meteorological satellite. The ALGOL procedures are detailed. ESA

N77-21539# Royal Aircraft Establishment, Farnborough (England).
REMOTE-SENSING EXPERIMENTS FROM SKYLARK SOUNDING ROCKETS
R. J. Jude Sep. 1976 55 p refs
(RAE-TR-76122; BR55389) Avail: NTIS HC A04/MF A01

The development and performance of photographic payloads carried on three Skylark rockets, one fired from Woomera, South Australia and two from Mercedes, San Luis Province, Argentina are described. The methods used for prediction of the performance of the photographic systems and the estimation of the required camera exposures are given. For each rocket firing the choice of photographic emulsions and filters is detailed, and examples are given of the imagery obtained. Measurements made on the imagery have validated the methods used for the prediction of the performance of the photographic systems. Author (ESA)

N77-21540# Soil Conservation Service, Washington, D. C.
WSP2 COMPUTER PROGRAM: A WATER SURFACE PROFILE COMPUTER PROGRAM FOR DETERMINING FLOOD ELEVATIONS AND FLOOD AREAS FOR CERTAIN FLOW RATES. USER'S GUIDE
May 1976 66 p Sponsored by Dept. of Agriculture
(PB-260751/3; USDA-SCS-TR-61; USDA-DF-76-004a) Avail: NTIS HC A04/MF A01 CSCL 13B

The WSP2 (Water Surface Profile 2) computer program aids in the determination of flow characteristics for a given set of stream and flood plain conditions. More specifically, it computes water surface profiles in open channels. The program also estimates head losses at restrictive sections, including roadways with either a bridge opening or culverts. WSP2 is written in FORTRAN 4 computer language and was developed on an IBM 360/65 computer. The three subprograms (HROFDA, DATE, and REREAD) were written in assembly language. The program requires about 220 kilobytes of core storage and three temporary data files. GRA

N77-21541# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
AN ANALYSIS OF GREAT LAKES ICE COVER FROM SATELLITE IMAGERY
Brenda Blanton Hagman Apr. 1976 17 p refs
(PB-261835/3; NOAA-TM-ERL-GLERL-9; NOAA-76101302)

Avail: NTIS HC A02/MF A01 CSCL 04B

Remotely sensed satellite data present a synoptic view of the distribution and extent of the Great Lakes ice cover. The major reason for extracting ice cover information from satellite imagery is the desire to extend the navigation season on the Great Lakes. One method of obtaining this type of information is to measure satellite transparency density and then correlate calculated surface reflectance with ice cover concentration. But the use of transparencies presents several difficulties, such as the problem of variable film densities. Because of the variability inherent in satellite transparencies and inaccurate ground verification data, it is desirable to find a better method of extracting ice cover information. GRA

N77-21542# Oklahoma Univ., Norman. Bureau of Water Resources Research.

A COARSE SORT SYSTEM FOR PRELIMINARY WATER RESOURCES MANAGEMENT ALTERNATIVES

George W. Reid and Nancy Safarik Jul. 1976 182 p refs

(Contract DI-14-34-0001-6037)

(PB-260491/6; W77-01055; OWRT-A-054-OKLA(1)) Avail: NTIS CSCL 13B

The Coarse Sort System is a non-mathematical model which provides a method for easily evaluating both quantitative and non-quantitative data and selecting a viable plan from among alternatives at the preliminary planning level. The Coarse Sort System requires that after alternative plans are developed, they be ranked according to how close they come to meeting the goals of the project. GRA

N77-21543# National Committee for the International Hydrological Decade, Washington, D. C. Work Group on the Hydrology of Carbonate Terranes.

WATER IN CARBONATE ROCKS: US PROGRESS IN PERSPECTIVE Final Report

1976 52 p refs

(Contract NSF C-310)

(PB-261548/2; LC-76-43525) Avail: NTIS HC A04/MF A01 CSCL 08H

Basic characteristics and problems of carbonate hydrology are described. The history of its study, mostly in the United States, over the past half century is also presented. Conclusions are drawn and recommendations offered for research, educational, and instutional needs, and technology transfer and development. GRA

N77-21544# Hawaii Univ., Honolulu. Dept. of Mechanical Engineering.

SIMILARITY SOLUTIONS FOR CONVECTION OF GROUNDWATER ADJACENT TO HORIZONTAL IMPERMEABLE SURFACES WITH AXISYMMETRIC TEMPERATURE DISTRIBUTION

P. Cheng and W. C. Chau 30 Apr. 1976 26 p refs

(Contract E(04-3)-1093; Grant NSF GI-38319)

(PB-261559/9; HGP-TR-14; NSF/RA-760373) Avail: NTIS HC A03/MF A01 CSCL 08I

The axisymmetric buoyancy-induced ground-water flow adjacent to horizontal impermeable surfaces with wall temperature being a power function of radius is discussed. With the boundary layer simplifications, the governing nonlinear partial differential equations can be transformed into a coupled pair of non-linear ordinary differential equations with two-point boundary conditions that can be integrated numerically by established techniques. Simple algebraic expressions for boundary layer thickness and heat transfer rate are obtained. Applications to free convective flow in a liquid-dominated geothermal system at high Rayleigh number are discussed. GRA

N77-21545# PRC Information Sciences Co., McLean, Va.

PROGRAM MAINTENANCE MANUAL FOR THE REFERENCE SCENE SOFTWARE (RSS)

Carolyn B. Shelton 15 Oct. 1976 76 p

(Contract DAAK02-75-C-0098)

(AD-A033480; PRC-R-1939; ETL-0067) Avail: NTIS HC A05/MF A01 CSCL 17/9

The Reference Scene Software (RSS) is a set of eleven CDC 6400 computer programs used in-house at the U.S. Army Engineer Topographic Laboratories (USAETL), Ft. Belvoir, Virginia, to produce simulated Plan Position Indicator (PPI) radar scenes. The two inputs required by RSS are a matrix array (raster format) of digital terrain elevations and a corresponding vector digitized list of planimetry features (roads, lakes, railroads, cities, rivers, etc.). The output of RSS is raster format magnetic tape image of the circular PPI scene, which is later formatted onto 35mm film and machine compared to the actual PPI scene of the area to determine the goodness of correlation. These programs were originally developed by the Naval Training Equipment Center (NTEC), Orlando, Florida, for visual flight simulation. They were converted to run on the ETL CDC 6400 computer, new input and output routines were developed, and the radar modeling algorithm was changed to produce a better machine readable, rather than better human readable, scene. RSS is being used to determine the data base input requirements and the radar modeling algorithm parameters necessary for producing correlatable reference scenes. Author (GRA)

N77-21546# Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.

ESTIMATING AQUIFER PERMEABILITY BY SURFACE ELECTRICAL RESISTIVITY MEASUREMENTS Final Report

Will E. Kelly Sep. 1976 48 p refs

(Grant NSF GK-42130)

(PB-261584/7) Avail: NTIS HC A03/MF A01 CSCL 08H

Aquifer electrical resistivities were determined from the results of Schlumberger electrical soundings made at six sites in Southern Rhode Island where pumping tests had previously been made. Measurements of electrical resistivity and permeability were also made concurrently in the laboratory using a modified falling head permeameter. Results show that electrical resistivities determined from soundings can be used to predict aquifer permeability; an empirical relation between aquifer electrical resistivity and aquifer permeability was developed. Semi-empirical relations between formation factor and permeability were also developed. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N77-21547*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

OPERATIONS RESEARCH INVESTIGATIONS OF SATELLITE POWER STATIONS

John W. Cole and John L. Ballard (Nebraska Univ., Lincoln) Dec. 1976 41 p refs

(NASA-TM-X-73372) Avail: NTIS HC A03/MF A01 CSCL 10A

A systems model reflecting the design concepts of Satellite Power Stations (SPS) was developed. The model is of sufficient scope to include the interrelationships of the following major design parameters: the transportation to and between orbits; assembly of the SPS; and maintenance of the SPS. The systems model is composed of a set of equations that are nonlinear with respect to the system parameters and decision variables. The model determines a figure of merit from which alternative concepts concerning transportation, assembly, and maintenance of satellite power stations are studied. A hybrid optimization model was developed to optimize the system's decision variables. The optimization model consists of a random search procedure and the optimal-steepest descent method. A FORTRAN computer program was developed to enable the user to optimize nonlinear functions using the model. Specifically, the computer program was used to optimize Satellite Power Station system components. Author

N77-21548*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF THE SEM TO THE MEASUREMENT OF SOLAR CELL PARAMETERS
Victor G. Weizer and Charles W. Andrews 1977 8 p refs Presented at 10th Ann. Scanning Electron Microscopy Symp., Chicago, 28 Mar. - 1 Apr. 1977; sponsored by IIT
(NASA-TM-X-73637; E-9138) Avail: NTIS HC A02/MF A01 CSCL 10A

Techniques are described which make use of the SEM to measure the minority carrier diffusion length and the metallurgical junction depth in silicon solar cells. The former technique permits the measurement of the true bulk diffusion length through the application of highly doped field layers to the back surfaces of the cells being investigated. It is shown that the secondary emission contrast observed in the SEM on a reverse-biased diode can depict the location of the metallurgical junction if the diode has been prepared with the proper beveled geometry. The SEM provides the required contrast and the option of high magnification, permitting the measurement of extremely shallow junction depths. Author

N77-21549*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESULTS OF BASELINE TESTS OF THE EVA METRO SEDAN, CITI-CAR, JET INDUSTRIES ELECTRA-VAN, CDA TOWN CAR, AND OTIS P-500 VAN
Francis J. Stenger, John M. Bozek, and Richard F. Soltis Oct. 1976 78 p
(Contract E(49-28)-1011)
(NASA-TM-X-73638; E-9140) Avail: NTIS HC A05/MF A01 CSCL 10B

Five electric vehicles were tested at vehicle test tracks using the SAE. The tests provide range data at steady speeds and for several driving cycles. Most tests were conducted with lead-acid traction batteries. The Otis Van and the Copper Electric Town Car were also tested with lead-acid and nickel-zinc batteries. The tests showed a range increase of from 82 to 101 percent depending on vehicle, speed, and test cycle. Author

N77-21550*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 1976 GODDARD SPACE FLIGHT CENTER BATTERY WORKSHOP
Nov. 1976 360 p Workshop held at Greenbelt, Md., 9-10 Nov. 1976
(NASA-TM-X-71284; X-711-77-28) Avail: NTIS HC A16/MF A01 CSCL 10C

The latest results of testing, analysis and development of sealed nickel cadmium cells and batteries and developments in the nickel-hydrogen system are discussed. Author

N77-21551*# AiResearch Mfg. Co., Torrance, Calif.
BRAYTON-CYCLE HEAT EXCHANGER TECHNOLOGY PROGRAM Final Report
J. J. Killackey, M. G. Coombs, R. F. Graves, and C. J. Morse Aug. 1976 365 p refs
(Contract NAS3-15347)
(NASA-CR-135158; AiResearch-73-12055) Avail: NTIS HC A16/MF A01 CSCL 10B

The following five tasks designed to advance this development of heat exchanger systems for close loop Brayton cycle power systems are presented: (1) heat transfer and pressure drop data for a finned tubular heat transfer matrix. The tubes are arranged in a triangular array with copper stainless steel laminate strips helically wound on the tubes to form a disk fin geometry; (2) the development of a modularized waste heat exchanger. Means to provide verified double containment are described; (3) the design, fabrication, and test of compact plate fin heat exchangers representative of full scale Brayton cycle recuperators; (4) the analysis and design of bellows suitable for operation at 1600 F and 200 psia for 1,000 cycles and 50,000 hours creep life; and (5) screening tests used to select a low cost braze alloy with the desirable attributes of a gold base alloy. A total of 22 different alloys were investigated; the final selection was Nicrobraz 30. Author

N77-21552# Miami Univ., Coral Gables, Fla.
FIRST WORLD HYDROGEN ENERGY CONFERENCE PROCEEDINGS, VOLUME 1
T. Nejat Veziroglu, ed. Mar. 1976 744 p refs Conf. proc. held at Miami Beach, Fla., 1-3 Mar. 1976 Sponsored in part by ERDA 3 Vol.
Avail: NTIS HC A99/MF A01

Conference preceedings are presented on various methods to produce hydrogen energy, using solar radiation, nuclear reactors, chemical reactions, water splitting, and coal gasification. For individual titles, see N77-21553 through N77-21590.

N77-21553# Kernforschungsanlage, Juelich (West Germany).
HYDROGEN PRODUCTION PROCESS BY MEANS OF NUCLEAR ENERGY
R. E. Harth and B. Hoehlein *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 15 p refs (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

The transfer of heat from a nuclear HTGR into a steam reforming plant is considered. The essential problems of such a steam reforming process were studied in a pilot plant EVA, which consists of one single reforming tube with industrial standard dimensions. The heat required for the endothermic process is transferred to the reforming tube by helium flowing under thermodynamic conditions comparable to those prevailing at the nuclear reactor core outlet. Author

N77-21554# Kernforschungsanlage, Juelich (West Germany).
THE CONCEPT OF NUCLEAR HYDROGEN PRODUCTION AND PROGRESS OF WORK IN THE NUCLEAR RESEARCH CENTER JUELICH
R. Schulten, H. Barnert, H. Fedders, G. Grziwa, and A. Schulte *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 14 p refs (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

Results are given of the experimental work on the sulfate cycle and on the reverse Deacon reaction pair. For the key reaction of the sulfate cycle ($MeO + SO2 + H2O$ yields $MeSO4 + H2$) several metals (Mn, Fe, Co, Ni, Zn, Cd) were tested, some with a small success. The two reactions of the reverse Deacon reaction pair show good conversion and relatively fast kinetics. An over view of the state of the art of HTR heat consuming apparatus is given. Author

N77-21555# Eidgenoessisches Institut fuer Reaktorforschung, Wuerenlingen (Switzerland).
A SYMBIOTIC NUCLEAR ENERGY PARK AS THE ULTIMATE PRIMARY ENERGY SOURCE FOR SWITZERLAND - GENESIS AND RATIONALE
S. Huwyler and W. Seifritz *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 48 p refs (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

The potential reactor family, consisting exclusively of fast breeder reactors (FBR) and various high temperature gas cooled reactors (HTGR's), are assembled as an underground nuclear energy park in a mountain of the alps. The main feature of the symbiotic reactor system is the coupled fuel cycle which will then permit practically a uranium-ore-and separative-work-independent energy economy. It is shown that the amount of natural uranium and thorium which is necessary to feed the system in equilibrium can be effectively extracted from granite of the Swiss alps where an abundant amount of these rocks is available having a content of 80-100 ppm uranium and thorium with the required ratio of U to Th. The whole system is considered to be the ultimate primary energy source of an all energy economy based on clean and wasteless secondary energy carriers like electricity, H2 for industry, reducing gases, Adam-Eva heat, and hot water. Author

N77-21556# Michigan Univ., Ann Arbor. Dept. of Nuclear Eng.
THE AQUEOUS HOMOGENEOUS REACTOR AS A SOURCE OF HYDROGEN AND OF PROCESS HEAT
D. P. Majumdar, H. Reyes, and W. Kerr *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 23 p

refs (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

The use of a two region aqueous reactor for the dual purpose of production of hydrogen and of process steam is investigated. Hydrogen production both in the core and in the blanket is discussed. Two independent loops for hydrogen extraction are considered, one for the core and one for the blanket. The neutron leakage from core to blanket along with the resulting hydrogen production rates are calculated for several core sizes. These calculations do not indicate an optimum core size for maximization of hydrogen production in the blanket region. Author

N77-21557# General Atomic Co., San Diego, Calif.
WATER SPLITTING - A PROGRESS REPORT
J. L. Russell, Jr., K. H. McCorkle, J. H. Norman, J. T. Porter, II, T. S. Roemer, J. R. Schuster, and R. S. Sharp *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 21 p refs (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

The most important result of the water-splitting program to date was the choice of a prime cycle and a few alternates for further process development. Engineering analysis of the most promising one has begun and suggests a high (possibly in the vicinity of 50%) efficiency for the cycle. This cycle can be an all liquid and gas phase cycle (although one step may involve pumping a room temperature slurry), a characteristic which may give it considerable engineering advantage over a cycle requiring solids handling. The cycle heat requirements appear to match the HTGR output capability. Author

N77-21558# Institute of Gas Technology, Chicago, Ill.
COMPETITIVELY PRICED HYDROGEN VIA HIGH-EFFICIENCY NUCLEAR ELECTROLYSIS
W. J. D. Escher and T. D. Donakowski *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 20 p refs (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

A fully dedicated nuclear electrolytic, hydrogen production facility, based on advanced technology, was synthesized and assessed at the conceptual level. The facility integrates (1) an HTGR operating a binary shaftpower extraction cycle at 980 C (1800 F) top temperature, (2) direct dc electricity generation via acyclic generators, and (3) high current density, high pressure electrolyzers based on the solid polymer electrolyte approach. All subsystems are close-coupled and optimally interfaced. Pipeline pressure hydrogen and coproduct oxygen are produced at 6,900 kPa (1,000 psi). Author

N77-21559# Arya Mehr Univ. of Technology, Teheran (Iran).
HYDROGEN PRODUCTION FROM NUCLEAR WASTE ENERGY
R. Hatami *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 21 p refs (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

Mentioning H2 leads to the ideas of a H2- technology. This bases not only on the expectations on the nuclear energy, but also on different chemical processes for H2-formation. While the success is still not sure, the implications of a H2- technology were studied. Besides the environmental advantages (no hydrocarbons), it was found that from combustion technology a replacement of natural gas by hydrogen would cause only minor difficulties. This would concern only premixed flames, while with diffusion flames no real difficulties are expected. It is shown how H2 can be produced from nuclear waste energy. Author

N77-21560# Atomic Energy of Canada Ltd., Chalk River (Ontario).
PEAK POWER AND HEAVY WATER PRODUCTION FROM ELECTROLYTIC H2 AND O2 USING CANDU REACTORS
M. Hammerli, W. H. Stevens, W. J. Bradley, and J. P. Butler *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 27 p refs (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

A combined energy storage, heavy water production system is presented. Off-peak nuclear energy is stored in the form of electrolytic H2 (and O2) from which a large fraction of the deuterium was transferred to water in an H2/H2O deuterium exchange catalytic column. The main features and advantages of the combined electrolysis, catalytic exchange D2O process are discussed. Significant quantities of D2O could be produced economically at reasonable peak to base power cost ratios. Thirty to forty percent of the primary electric energy should be available for peak energy via either gas-steam turbines or fuel cells. Author

N77-21561# Brookhaven National Lab., Upton, N.Y. Dept. of Applied Science.
HYDROGEN PRODUCTION OPTIONS USING FUSION ENERGY
J. Powell, F. J. Salzano, E. Beardsworth, and J. Karkheck *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 4 p (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

A comprehensive study was made of the technical and economic aspects of hydrogen production options using fusion energy. The options investigated involve: (1) choice of fusion reaction (DT fuel or fusion-fission); (2) choice of power conversion method (conventional Brayton gas turbine cycle or HEP (High Efficiency Power) cycle); and (3) choice of production plant: H2 only, electricity and H2, electricity, and H2 with distribution of hot water, waste heat for space heat and industrial applications, and a multi-purpose fusion energy integrated industrial park (electricity, H2, and industrial process heat). All options employ a Tokamak magnetic confinement system with noncircular plasma cross section and a gas cooled high temperature (approximately 1000 C) graphite blanket. In each option, hydrogen is produced by electrolysis with a cell efficiency of 80%. Author

N77-21562# Houston Univ., Tex. Solar Energy Lab.
SOLAR TOWER CHARACTERISTICS
A. F. Hildebrandt and L. L. Vant-Hull *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 12 p refs (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

The solar tower (or central receiver) studies have shown technical and economic feasibility for large-scale collection and conversion of solar beam radiation. The base line design at present is a 100 MWe unit with six hours of thermal storage. This requires a 1.5 km x 1.8 km array of heliostats with a steam boiler atop a 330 meter tower. A major advantage of the solar tower concept is that high temperatures (1300 K) are attainable at the receiver without excessive reradiation or convection losses and without the use of selective surfaces. This is possible because optical concentration ratios in excess of 1,000 can be achieved using a multiplicity of large, flat mirrors which can be made economically. The design, which utilizes 6.1 m octagonal mirrors assembled from eight triangular facets, allows partial focusing and even higher concentration. Author

N77-21563# Yokohama National Univ. (Japan).
WATER-SPLITTING-SYSTEM SYNTHESIZED BY PHOTOCHEMICAL AND THERMOELECTRIC UTILIZATIONS OF SOLAR ENERGY
T. Ohta, N. Kamiya, M. Yamaguchi, N. Gotoh, T. Otagawa, and S. Asakura *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 12 p refs (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

Valuable hybrid systems for hydrogen production by the solar energy were developed, and the system efficiency was estimated and discussed from the various points of view. In order to split water into hydrogen and oxygen without draining out any by-products, a steady stream of the reacting materials should be maintained in the consecutive reaction processes. If the system has a rate determining step, the extra energy should be supplied to promote the reaction. In the Yokohama Mark 5, the efficiency of the thermoelectric device is as low as 5%, however the overall efficiency of hydrogen production can be raised up to 20% by adding extra electric power. A hybrid system combining photochemical, thermochemical, and electrochemical reactions was also discussed from energetic point of view. Author

N77-21564# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
DESIGN OF AN OCEAN THERMAL ENERGY PLANT SHIP

TO PRODUCE AMMONIA VIA HYDROGEN

G. L. Dugger and E. J. Francis *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 38 p refs (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

A baseline design was developed for a 100-MWe ocean thermal energy conversion plant ship that would produce 313 tons per day of ammonia. The cost estimates for this design were extrapolated to 500 MWe plants to produce ammonia (for fertilizers and chemicals) or liquid hydrogen for shipment to the U.S. It was surmised that ammonia will be producible at competitive cost by 1982-85 with reasonable financing arrangements. This would conserve supplies of natural gas or other fossil fuels now used to produce ammonia on shore. Author

N77-21565# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.

SYNTHETIC FUELS FROM SOLID WASTES AND SOLAR ENERGY

M. J. Antal, Jr., R. C. Feber (Los Alamos Scientific Lab., N. Mex.), and M. C. Tinkle (Los Alamos Scientific Lab., N. Mex.) *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 21 p refs (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

The use of solar process heat for the gasification of organic solid wastes and the production of hydrogen is examined. The hydrogen production potential of solid wastes is calculated, and two gasification processes are discussed and analyzed in detail. Economic projections are favorable. Author

N77-21566# Institute of Gas Technology, Chicago, Ill.

THE MANUFACTURE OF HYDROGEN FROM COAL

C. L. Tsaros, J. L. Arora, and K. B. Burnham *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 24 p refs (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

As part of a study for the conversion of coal to fluid fuels, three process designs were developed for the conversion of Montana subbituminous coal to hydrogen based on three different gasifier technologies: (1) Koppers-Totzek suspension gasification, (2) U-GAS fluidized-bed gasification, and (3) fluidized steam-iron process. For comparison with methane from coal, a fourth design, based on the HYGAS Process, was prepared. Nominal plant capacities are 250 billion Btu/day of product gas. Overall plant efficiencies for conversion of coal to major gaseous products plus by-products are: Koppers-Totzek 57.0%, U-GAS 66.4%, steam-iron 62.6% (includes 18% by-product electricity), and HYGAS 74.0%. Product liquefaction requirements are presented. Capital and operating costs (mid-1974) are presented for U-GAS and HYGAS. Author

N77-21567# Koppers Co., Inc., Pittsburgh, Pa.

THE K-T PROCESS: KOPPERS COMMERCIALLY PROVEN COAL AND MULTI-FUEL GASIFIER FOR SYNTHETIC GAS PRODUCTION IN THE CHEMICAL AND FERTILIZER INDUSTRIES

R. Wintrell *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 28 p (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

The K-T gasification process is discussed. The process gasifies the complete range of solid, liquid, and gaseous hydrocarbon fuels. The process from coal grinding through drying and pulverization, to classification, storage and final transfer to storage and feed bins at the gasifier is described. From the feed bins, the process is examined through the screw feeders to fuel entrainment after the mixing head and transfer to the burner. The necessary safety and control precautions are outlined. Within the gasifier, the thermal and equilibrium reactions, together with the benefits of high temperature operation on the final gas composition, are discussed. After exit from the gasifier, gas cooling and recovery of the sensible heat in the gas are proven to be necessary to maintain high process efficiencies. Author

N77-21568# General Atomic Co., San Diego, Calif.

HYDROGEN PRODUCTION FROM COAL USING A NUCLEAR HEAT SOURCE

R. N. Quade *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 14 p refs (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

A strong candidate for hydrogen production in the intermediate time frame of 1985 to 1995 is a coal-based process using a high-temperature gas-cooled reactor (HTGR) as a heat source. Expected process efficiencies in the range of 60 to 70% are considerably higher than all other hydrogen production processes except steam reforming of a natural gas - a feedstock which may not be available in large quantities in this time frame. The process involves the preparation of a coal liquid, hydrogasification of that liquid, and steam reforming of the resulting gaseous or light liquid product. Bench-scale experimental work on the hydrogasification of coal liquids is being carried out. A study showing process efficiency and cost of hydrogen vs nuclear reactor core outlet temperature was completed, and shows diminishing returns at process temperatures above about 1500 F. Author

N77-21569# Rohm and Haas Co., Bristol, Pa.

A LOW TEMPERATURE, THREE-STEP WATER SPLITTING PROCESS

P. A. Kittle, D. F. Mahoney, and J. E. Schuler *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 5 p (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

The system, based on iodine chemistry, depends upon the generation of an intermediate solid phase to reverse an unfavorable equilibrium constant. The chemistry leading to the clean generation of hydrogen and oxygen, as well as some of the process concepts, is described. Author

N77-21570# National Chemical Lab. for Industry, Tokyo (Japan).

THE CALCIUM-IODINE CYCLE FOR THE THERMOCHEMICAL DECOMPOSITION OF WATER

K. Fujii, W. Kondo, S. Mizuta, and T. Kumagai *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 19 p refs (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

A cycle consisting of the following four reactions was proposed for thermal decomposition of water: the redox reaction of iodine with calcium hydroxide, thermal decomposition of calcium iodate, hydrolysis of calcium iodide, and thermal dissociation of hydrogen iodide. Each of those reactions was experimentally confirmed, and the thermal efficiency of this process was evaluated based on the material and heat flow sheet. Author

N77-21571# Los Alamos Scientific Lab., N. Mex.

PROGRESS IN THE LOS ALAMOS SCIENTIFIC LABORATORY PROGRAM TO DEVELOP THERMOCHEMICAL PROCESSES FOR HYDROGEN PRODUCTION

M. G. Bowman *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 10 p refs (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

This program is based on attempts to develop criteria required of an ideal process and to search for types of thermochemical cycles that approximate these criteria. The advantages of reactions with large entropy changes were demonstrated, and the necessity for experimental verification of conceptual cycles became apparent. It should be emphasized that any comparison of conceptual cycles or of engineering or cost analyses must eventually be based on real, rather than assumed, data. Author

N77-21572# Technische Hochschule, Aachen (West Germany). Lehrstuhl fuer Technische Thermodynamik.

FEASIBILITY STUDIES OF CHEMICAL REACTIONS FOR THERMOCHEMICAL WATER SPLITTING CYCLES OF THE IRON-CHLORINE-, IRON-SULFUR- AND MANGANESE-SULFUR FAMILIES

K. F. Knoche, H. Cremer, G. Steinborn, and W. Schneider *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 46 p refs (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

The number of chemical reactions in water splitting cycles of the iron-chlorine, iron-sulfur, and manganese-sulfur families is quite high from a thermodynamic point of view. Applying chemical

engineering criteria to the reactions allows the cancelling of unfavorable steps. The remaining reactions can be systemized to typical groups. Experimental results of these groups of reactions are presented, depending on temperature, ratio of reactants, and reaction performance. The results are discussed with respect to the performance of the chemical reactions in water splitting cycles. Author

N77-21573# Los Alamos Scientific Lab., N. Mex.
THE REDUCTION OF HYDROGEN BROMIDE USING TRANSITION METAL COMPOUNDS
C. F. V. Mason *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 14 p refs (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

Ways of accelerating the redox reaction between chromous bromide and hydrogen bromide to form chromic bromide and hydrogen were examined at room temperature. The process, although thermodynamically favorable, is extremely slow kinetically. Marked increases in rate were obtained by using the hydrate, pyridine, and dipyridyl complexes of chromium. In conjunction with catalysts, hydrogen yields of up to 71% in 10 minutes were obtained. The significance of these results is discussed in the framework of closed thermochemical cycles for preparing hydrogen. Author

N77-21574# Direction des Etudes et Techniques Nouvelles (France).
THERMODYNAMICS OF THERMOCHEMICAL WATER DECOMPOSITION PROCESSES
B. Esteve, A. Lecoanet, and J. P. Roncato *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 22 p refs (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

Thermochemical and electrolytic methods of hydrolysis are subject to the same theoretical limits, and the choice between them will depend only on the importance of irreversibilities related to their practical use. The irreversibilities of thermochemical processes have thermal, chemical, and mechanical origins. In the case of optimal organization of the circulation of chemicals as well as of matching with a nuclear reactor, a very general estimation of losses of thermal origin shows the considerable influence of the characteristics of the reactions and compounds involved; for average values of these characteristics, it seems that the thermal efficiencies of thermochemical methods are close to those of electric generating plants using the same heat sources. Results of the thermodynamic study are discouraging for the use of thermochemical methods. Only automatic computer analysis permits the determination of cycles which are competitive with electrolysis. Author

N77-21575# Wisconsin Univ., Madison. Dept. of Chemical Engineering.
DISCOVERY OF REACTION SEQUENCES FOR THERMOCHEMICAL WATER SPLITTING
D. May and D. F. Rudd *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 28 p refs (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

Methods for the synthesis of reaction cycles to decompose water are described. Stoichiometry and thermodynamics, the necessary conditions for every reaction, are the foundation of the proposed approach. Author

N77-21576# Tokyo Univ. (Japan). Dept. of Chemical Engineering.
EFFECTIVE CONVERSION PROCESSES BETWEEN THERMAL AND CHEMICAL ENERGIES: THERMODYNAMIC STUDY OF MULTISTEP WATER DECOMPOSITION PROCESSES
Kunio Yoshida and Hideo Kameyama *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 16 p refs (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

A systematic search method for thermodynamically feasible multistep processes and evaluation procedures is described, both from the thermodynamic point of view by introducing the concept of exergie, and from the technical point of view, based on the overall thermal efficiency. Author

N77-21577# Technische Hochschule, Aachen (West Germany). Lehrstuhl fuer Technische Thermodynamik.
BALANCE AND OPTIMIZATION PROCEDURE FOR THERMOCHEMICAL CYCLES FOR HYDROGEN PRODUCTION
K. F. Knoche, H. Cremer, and W. Eisemann *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 12 p refs (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

A computer program for the balance and optimization of thermochemical cycles for hydrogen production is presented. This program can be used for qualified choice of cycles as well as for the design and development of processes. The approach is demonstrated with respect to cycles of the iron-chlorine family. Author

N77-21578*# Kentucky Univ., Lexington. College of Engineering.
A THERMOCHEMICAL DATA BANK FOR CYCLE ANALYSIS
R. H. Carty, J. E. Funk, W. L. Conger, M. A. Soliman (Riyadh Univ., Saudi Arabia), and K. E. Cox (New Mexico Univ.) *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 6 p refs (For primary document see N77-21552 12-44)
(Grant NGR-18-001-086)
Avail: NTIS HC A99/MF A01

The use of a computer program PAC-2 to produce a thermodynamic data bank for various materials used in water splitting cycles is described. The sources of raw data and a listing of 439 materials for which data are available are presented. The use of the data bank in conjunction with two other programs, CEC-72 and HYDRGN, is also discussed. The integration of these three programs implement an evaluation procedure for thermochemical water splitting cycles. CEC-72 is a program used to predict the equilibrium composition of the various chemical reactions in the cycle. HYDRGN is a program which is used to calculate changes in thermodynamic properties, work of separation, amount of recycle, internal heat regeneration, total thermal energy, and process thermal efficiency for a thermochemical cycle. Author

N77-21579# European Atomic Energy Community, Ispra (Italy). Materials Div.
THE COMPATIBILITY OF CONTAINMENT MATERIALS FOR THERMOCHEMICAL HYDROGEN PRODUCTION
F. Coen-Porisini and G. Imarisio *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 56 p refs (For primary document see N77-21552 12-44)
Avail: NTIS HC A99/MF A01

The material compatibility problems associated with thermochemical hydrolysis cycles are reviewed. Compatibility data are given for the Mark 1 cycle (HBr-HgBr2) and for halide compounds (C12, I2) in view of the development of other cycles. Experimental facilities set up for working in the particularly high corrosive media are described. Corrosion tests were carried out for times up to some thousand hours and at temperatures up to 800 C in static and dynamic conditions. The corrosion phenomena were evaluated by weight change measurements, microscopic examinations, S.E.M., and X-ray diffraction analysis. From the results of these studies, it appears that potential materials to be used in the particular environments envisaged exist. In the high temperature ranges (above 600 C), ceramic materials will probably be largely used because of the limited range of promising metallic alloys and their relatively high corrosion rates. The use of ceramics presents several problems, and possible engineering solutions for specific equipments are outlined. Author

N77-21580# Institute of Gas Technology, Chicago, Ill.
LABORATORY INVESTIGATIONS ON THERMOCHEMICAL HYDROGEN PRODUCTION
J. Pangborn *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 24 p refs Sponsored in part by the Am. Gas. Assoc. (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

Detailed energy efficiency determinations were made for more than 90 theoretically possible hydrogen production cycles, and the reaction steps of at least 60 cycles were tested. Theoretical studies and laboratory work indicate that important parameters are energy efficiency, energy sources, material corrosivity, hydrogen pressure capability, step rates, reaction kinetics, and material costs. One cycle that is experimentally workable and that exhibits many desirable characteristics - hydrogen pressure capability, high energy efficiency, and noncorrosive components - is based on the high temperature thermal decomposition of CdO. A high temperature solar furnace with a 1000 to 1200 C capability would be a suitable prime energy source. Author

N77-21581# Technische Hochschule, Aachen (West Germany). Lehrstuhl fuer Technische Thermodynamik.

EXPERIENCE OF A LABORATORY SCALE CYCLE FOR THERMOCHEMICAL HYDROGEN PRODUCTION AND PROPOSAL FOR TECHNICAL IMPLEMENTATION

K. F. Knoche, H. Cremer, D. Breywisch, S. Hegels, G. Steinborn, and G. Wuester *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 16 p refs (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

A 3-step process of the iron-chlorine family was selected for hydrogen production which operates with a chlorination step, a hydrolysis step for hydrogen production, and the reverse Deacon process for oxygen production. Both chlorination and hydrolysis are performed in fixed bed reactors. The separation of product gases is done by conventional methods. On the basis of the laboratory scale process a technical cycle is proposed and balanced. Author

N77-21582# Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.

HYDROGEN PRODUCTION BY MEANS OF REACTOR HEAT USING HALOGENS AND REVERSIBLE ELECTROCHEMICAL METHODS IN A CLOSED CYCLE PROCESS

S. Dorner and K. Schretzmann *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 47 p refs (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

It is shown that the formation of nitrosyl chloride and the transformation into HNO2 and HCl open up a way of reaching the first stage of closed cycle processes for H2 production through a sequence of reactions running at lower reaction temperatures. The HCl branch of the nitrosyl cyclic process was investigated. In theory, less electric energy is needed than with mere electrolysis of water. Cyclic processes incorporating reversible electrochemical processes seem to be simpler. The example cited is the cyclic process with cesium. According to theoretical calculations, the electric energy obtained from the first stage of this cyclic process should be sufficient to meet the electric energy requirements in the third stage. In this way, the cyclic process - although coupled with electric energy - would actually need only reactor heat for operation. The results indicate that new ways of hydrogen production by means of reactor heat are possible. Author

N77-21583# Joint Research Centre of the European Communities, Ispra (Italy).

HYDROGEN PRODUCING CYCLES USING ELECTRICITY AND HEAT HYDROGEN HALIDE CYCLES: ELECTROLYSIS OF HBr

G. H. Schuetz *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 18 p refs (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

An alternative to water electrolysis or thermochemical water splitting for hydrogen production could be a process using both electricity and heat. The electrolysis of hydrogen halides may be an important step of such hybrid processes. Some preliminary results obtained by electrolyzing concentrated hydrobromic acid with different electrode materials and at different temperatures are presented. High current densities were obtained at 1 V and less with electrodes of noble metals at low bromine concentrations. Author

N77-21584# European Atomic Energy Community, Ispra (Italy).

DEFINITION AND ANALYSIS OF THERMOCHEMICAL PROCESSES FOR HYDROGEN PRODUCTION BASED ON IRON-CHLORINE REACTIONS

A. Broggi, G. DeBeni, and D. VanVelzen *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 40 p refs (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

Activity on iron-chlorine cycles for hydrogen production is under way in many laboratories. The characteristics of these cycles are evaluated for their consequences on the overall thermal efficiency. The evaluation is made by the computer program OPTIMO, developed for this purpose. The results show that the thermal efficiency is strongly affected by the amount of heat related to the decomposition of iron trichloride, a reaction always present in these cycles. The necessity of careful attention to separation processes is underlined. Author

N77-21585# European Atomic Energy Community, Ispra (Italy).

DEVELOPMENT STUDIES ON THERMOCHEMICAL CYCLES FOR HYDROGEN PRODUCTION

D. VanVelzen and H. Langenkamp *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 26 p refs (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

Experimental work in the field of the development of cycles of the Fe/Cl family is described. It appears that application of a homogeneous support material for the gas-solids reaction is not feasible due to unexpected side reactions. The hydrolysis of ferrous chloride was found to give good results, and the development and operation of a continuously operating benchscale reactor for this reaction is described. The chlorination of the resulting magnetite was accomplished at 150-200 C with only hydrogen chloride and introduction of the reverse Deacon reaction as a fourth reaction in the cycle. Author

N77-21586# Los Alamos Scientific Lab., N. Mex.

THERMOCHEMICAL CYCLES UTILIZING SULFUR FOR HYDROGEN PRODUCTION FROM WATER

M. G. Bowman, E. I. Onstott, C. L. Peterson, and W. G. Witteman *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 6 p refs (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

Closed thermochemical cycles utilizing sulfur and oxides of calcium, lanthanum, and manganese were demonstrated experimentally. All are based on the following steps: (1) the equilibrium formation of sulfuric acid and sulfur from sulfur dioxide and water at low temperature; (2) the high temperature decomposition of sulfuric acid to produce sulfur dioxide for recycle and to evolve oxygen; (3) a reaction sequence involving metal oxide, metal sulfide, and metal carbonate for production of hydrogen sulfide from sulfur and water; and (4) the decomposition of hydrogen sulfide to produce hydrogen and sulfur for recycle. All reactions give reasonable yields and proceed at reasonable rates under properly chosen conditions. Author

N77-21587# Westinghouse Research Labs., Pittsburgh, Pa.

THE WESTINGHOUSE SULFUR CYCLE FOR THE THERMOCHEMICAL DECOMPOSITION OF WATER

L. E. Brecher, S. Spewock, and C. J. Warde *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 16 p refs (For primary document see N77-21552 12-44)

Avail: NTIS HC A99/MF A01

In the Westinghouse sulfur cycle, sulfurous acid and water are reacted electrolytically to produce hydrogen and sulfuric acid. The resultant sulfuric acid is vaporized to produce steam and sulfur trioxide, with the latter compound being subsequently reduced at higher temperatures into sulfur dioxide and oxygen. Following separation of the water and sulfur dioxide for recycle to the electrolyzer, oxygen is available as a process by-product. The cycle has the potential for achieving high thermal efficiencies while using common and inexpensive chemicals. The product hydrogen and oxygen streams are available under pressure and at high purity. As a result, these may be pipelined and used

without detrimental environmental effects and without jeopardizing processes which employ the gases. The chemical reactions comprising the cycle proceed at acceptable rates and without the occurrence of side reactions. Conceptual designs and cost estimates indicate that the product gas separations can be done conventionally and economically. Author

N77-21588*# Kentucky Univ., Lexington. College of Engineering.
PROCESS SENSITIVITY STUDIES OF THE WESTINGHOUSE SULFUR CYCLE FOR HYDROGEN GENERATION
R. H. Carty, K. E. Cox (New Mexico Univ., Albuquerque), J. E. Funk, M. A. Soliman (Riyadh Univ., Saudi Arabia), W. L. Conger, L. E. Brecher (Westinghouse Res. Labs., Pittsburh), and S. Spewock (Westinghouse Res. Labs., Pittsburgh) *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 12 p refs (For primary document see N77-21552 12-44)
(Contract NAS3-18934)
Avail: NTIS HC A99/MF A01

The effect of variations of acid concentration, pressure, and temperature on the thermal process efficiency of the Westinghouse sulfur cycle was examined using the HYDRGN program. Modifications to the original program were made to duplicate the process flowsheet and take into account combined cycle heat-to-work efficiencies for electrochemical work requirements, aqueous solutions, and heat-of-mixing effects. A total of 125 process variations were considered (acid concentration: 50-90 w/o; pressure: 15-750 psia; temperature: 922K - 1366K). The methods of analysis, results, and conclusions are presented. Author

N77-21589*# Westinghouse Electric Corp., Pittsburgh, Pa.
HYDROGEN PRODUCTION BY WATER DECOMPOSITION USING A COMBINED ELECTROLYTIC THERMOCHEMICAL CYCLE
G. H. Farbman and L. E. Brecher *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 22 p refs (For primary document see N77-21552 12-44)
(Contract NAS3-18934)
Avail: NTIS HC A99/MF A01

A nuclear water decomposition plant was designed which produces electrolytically pure hydrogen at the rate of about 380 million SCF per day, and acquires electric power and thermal energy from a VHTR system of about 3345 MWt. The system is based on the use of sulfur compounds in a hybrid electrolytic - thermochemical cycle, the sulfur cycle water decomposition system. Electric power and heat are used for the electrolytic production of hydrogen and a thermochemical step which closes the cycle and produces oxygen. The combined process operates at an overall thermal efficiency in excess of 45 percent, including the power requirements for plant auxiliaries. The overall economics of hydrogen production by this method were compared to conventional water electrolysis and coal gasification. Costs, prepared on a consistent set of economic ground rules, are presented. It was concluded that nuclear water decomposition plants of the type described show great promise of economic superiority in the time period for which they can practically be developed and put into operation, i.e., the 1990's. Author

N77-21590# Westinghouse Research Labs., Pittsburgh, Pa.
THE THERMAL CATALYTIC DECOMPOSITION OF SULFUR TRIOXIDE TO SULFUR DIOXIDE AND OXYGEN
S. Spewock, L. E. Brecher, and F. Talko *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 16 p (For primary document see N77-21552 12-44)
Avail: NTIS

Kinetic results were obtained on the thermal catalytic decomposition of sulfur trioxide in the Westinghouse sulfur cycle for splitting water. Using rate data obtained for two different catalysts, a kinetic mechanism was proposed, and modeling equations derived. The rate constant follows the Arrhenius Equation. Both the pre-exponential factor and the energy of activation were determined. For the first of these catalysts, the activation energy is 54.5 kcal/mole K and the pre-exponential factor is 7.66 x 10 to the 13th power/hr. For the second catalyst, WX-2, the activation energy is 17.46 kcal/mole K and the pre-exponential factor is 2.45 x 10 to the 8th power/hr-1. The latter catalyst possesses sufficient activity for use in compactly designed decomposition reactors. The former does not. A life test exceeding 1,000 hours duration was performed on the more active of the two catalysts. The results of this test indicate no loss in catalyst activity after 1,000 hours at 1565 F. Author

N77-21591# Miami Univ., Coral Gables, Fla. Clean Energy Research Inst.
FIRST WORLD HYDROGEN ENERGY CONFERENCE PROCEEDINGS, VOLUME 2
T. Nejat Veziroglu, ed. Mar. 1976 660 p refs Proc. held at Miami Beach, Fla., 1-3 Mar. 1976 Sponsored by ERDA 3 Vol.
Avail: NTIS HC A99/MF A01

The production, delivery, and storage (in vehicles and metal hydride storage) of hydrogen were examined. Electrolytic hydrogen generators, micro-electrolysis, and water electrolysis were some of the methods of production discussed. The alternative production methods mentioned were farm energy systems, microbial production, and photosynthesis. For individual titles, see N77-21592 through N77-21625.

N77-21592# Teledyne Energy Systems, Timonium, Md.
RECENT DEVELOPMENTS OF LARGE ELECTROLYTIC HYDROGEN GENERATORS
J. B. Laskin and R. D. Feldwick *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 18 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

An overview of the history and market of large electrolysis units is presented. The historical background introduces and explains the thought process behind a design of Teledyne's Electra Cell alkaline electrolysis hydrogen generators. The new cell design enables construction of modules capable of 1.6 tons per day of hydrogen. The cost of hydrogen is used as a criteria for the selection of optimum performing cells as a function of user parameters. Author

N77-21593# Brookhaven National Lab., Upton, N.Y. Dept. of Applied Science.
PROSPECTS FOR HYDROGEN PRODUCTION BY WATER ELECTROLYSIS TO BE COMPETITIVE WITH CONVENTIONAL METHODS
S. Srinivasan and F. J. Salzano *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 15 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

The maximization of surface areas of electrodes, use of thin electrolyte layers, and increase of operating temperature in alkaline water electrolysis cells to about 120 to 150 C were discussed. Selection and evaluation of separator materials, electrocatalysis of the hydrogen and oxygen electrode reaction, mixed oxides as oxygen electrodes, and photoelectrochemical effects were also studied. Author

N77-21594# Miami Univ., Fla.
WATER ELECTROLYSIS UNDER PRESSURE: IMPROVEMENT OF ENERGY EFFICIENCY BY TEMPERATURE INCREASE
L. Mas (SRTI), J. C. Sohm (Domaine Univ.), and A. Damien (EDF) *In its* 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 24 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

A water electrolysis pilot plant (6.5 kW) of the filter-press type was built. The working pressure is 20 bars, the maximum current density 3.5 kA/m2 and the highest temperature 160 C. Serious corrosion problems were encountered due mainly to the caustic embrittlement of steels at temperatures higher than 120 C. At a given current density, the cell voltage hardly decreases when the temperature goes beyond 120 C if non-activated electrodes are used. Author

N77-21595# Oklahoma State Univ., Stillwater. School of Electrical Engineering.
PERFORMANCE CHARACTERISTICS OF A HIGH-PRESSURE, MODERATE TEMPERATURE, ELECTROLYSIS SYSTEM
H. Jack Allison *In* Miami Univ. 1st World Hydrogen Energy

Conf. Proc., Vol. 2 Mar. 1976 22 p refs 3 Vol. (For primary document see N77-21591 12-44)
(Grant NSF GI-39457)
Avail: NTIS HC A99/MF A01

A two kilowatt prototype system, based on a unique electrode design was constructed and tested. The system and the basic theory associated with the electrolytic production of hydrogen are summarized. Data related to the performance characteristics of the prototype cell are presented. Author

N77-21596# Billings Energy Research Corp., Provo, Utah.
DEVELOPMENT OF A LOW CAPITAL COST ELECTROLYZER
B. C. Campbell *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 14 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

An analysis of current large and small capacity electrolyzers indicates that for electrolytic hydrogen to become economically desirable more efficient and lower cost units need to be developed. Author

N77-21597# Energy Research Corp., Danbury, Conn.
HEAT TRANSFER ANALYSIS OF METAL HYDRIDES IN METAL-HYDROGEN SECONDARY BATTERIES
M. Onischak, D. Dharia, and D. Gidaspow (Institute of Gas Technology) *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 14 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

The heat transfer between a metal-hydrogen secondary battery and a hydrogen-storing metal hydride was studied. Temperature profiles of the endothermic metal hydrides and the metal-hydrogen battery were obtained during discharging of the batteries assuming an adiabatic system. Two hydride materials were considered in two physical arrangements within the battery system. The results show that for a typical 20 ampere-hour battery system with lanthanum pentanickel hydride as the hydrogen reservoir the system performs successfully. Author

N77-21598# Brown, Boveri & Cie Aktiengesellschaft, Baden (Switzerland).
MODERN TECHNOLOGY ELECTROLYSIS FOR POWER APPLICATION
R. Bidard (CEM, Paris) and U. LaRoche *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 23 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

The two important means of splitting water, i.e. thermolysis and electrolysis, are studied with an emphasis on the first one. The electrolysis possibilities are examined in regard to the possibilities of market penetration. Author

N77-21599# Stanford Univ., Calif.
HYDROGEN PRODUCTION PLANTS USING ELECTROLYTIC CELLS WITH LOW COST ELECTRODES BUILT INTO PRESSURE TANKS
F. F. Hall *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 32 p 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

Electrolytic production method of generating hydrogen gas is briefly reviewed, and critical components of electrolytic hydrogen production plants are listed. Recommended arrangement would be operated at moderate temperatures and gas pipe line pressures. A hypothetical 150 MW hydrogen plant is described, including estimates of cost and performance. Comments are made in regard to several possible generating systems which might be used to power hydrogen production plants. A comprehensive energy policy is appended. Author

N77-21600# Institute of Gas Technology, Chicago, Ill.
A FARM ENERGY SYSTEM EMPLOYING HYDROGEN STORAGE
R. R. Tison and N. P. Biederman *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 27 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

Short-range, small volume storage to integrate the operation of the wind energy conversion systems with fluctuations in wind availability and load requirements appears feasible. In some cases, hot water storage for thermal loads is preferable to hydrogen. Non-optimized costs for power supplied to a 100 head dairy farm discussed in this paper are in the range of 27 cents to 57 cents/kWhr. Optimized costs are anticipated, however, to be as low as 10 cents/kWhr. Author

N77-21601# Western Ontario Univ., London.
MICROBIAL HYDROGEN PRODUCTION
J. E. Zajic and J. Brosseau *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 40 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

Microbial production is one of the four processes available for the production of hydrogen from nonfossil primary energy sources. Autotrophy and heterotrophy, biological oxidation, and respiration, as well as fermentation were studied in regard to the production of hydrogen gas by microorganisms. Author

N77-21602# Adelaide Univ. (Australia).
THE PHOTOSYNTHETIC PRODUCTION OF HYDROGEN
G. Neil (Flinders Univ., Adelaide, Australia), D. J. D. Nicholas, J. OM. Bockris (Flinders Univ., Adelaide, Australia), and J. F. McCann (Flinders, Univ., Adelaide, Australia) *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 8 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

The rate of hydrogen produced from Anabaena cylindrica under an inert atmosphere and light irradiation was examined. An approximate estimate of the area required to produce hydrogen in adequate quantities from Anabaena cylindrica to provide enough energy for the needs of a city of a population of 1 million people was calculated. Author

N77-21603# Miami Univ., Fla. Rosenstiel School of Marine and Atmospheric Science.
BIOCONVERSION OF SOLAR ENERGY IN SALT WATER: PHOTOSYNTHETIC HYDROGEN PRODUCTION SYSTEMS
A. Mitsui *In its* 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 23 p refs Sponsored in part by NSF 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

Hydrogen photoproduction via marine photosynthetic systems is reviewed. Special emphasis is placed on the economic and logistical importance of using salt water as the hydrogen (proton) and electron donor in such a system. In addition, the advantages of using marine photosynthetic microorganisms are discussed from the standpoint of maintaining stable mass cultures with high solar conversion efficiencies. A program is outlined for the multiple utilization of hydrogen producing mass cultures, including harvesting cultures for food production, using cellular products for methane production, and isolating metabolically active cellular products for medical use. Author

N77-21604# Flinders Univ., Bedford Park (Australia). School of Physical Sciences.
THE THEORY OF HYDROGEN PRODUCTION IN A PHOTOELECTROCHEMICAL CELL
J. OM. Bockris and K. Uosaki *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 30 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

Theoretical expressions for p-type semiconductor electrodes are derived with an assumption that the discharge step is the rate determining step. Computations corresponding to these equations are carried out and show high quantum efficiencies for certain p-type semiconductors and very low quantum efficiencies for n-type semiconductors. Practical high quantum efficiency for TiO2 is explained by considering surface state. The relation between the potential of an individual electrode and a cell is considered, and cell potential-current relationships of a photo-driven cell are calculated for a solar energy. The predicted maximum efficiency of a cell is 4.7%. Author

N77-21605# Allied Chemical Corp., Morristown, N.J. Materials Research Center.

HYDROGEN GENERATION BY PHOTOELECTROLYSIS OF WATER

A. J. Nozik *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 24 p refs 3 Vol. (For primary document see N77-21591 12-44)

Avail: NTIS HC A99/MF A01

Photoelectrolysis of water was studied using n-type TiO2, CdS, and GaP semiconducting electrodes. Current-voltage characteristics and the electrode potentials of the semiconductors were obtained as a function of light intensity and wavelength, internal cell resistance and potential, pH, and cathode material. A model was developed which indicates that a two-photon process is involved, so that photoelectrolysis is sensitized to longer wavelengths. Author

N77-21606# Electrotechnical Lab., Tokyo (Japan).

FEASIBILITY OF HYDROGEN PRODUCTION BY DIRECT WATER SPLITTING AT HIGH TEMPERATURE

S. Ihara *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 16 p refs 3 Vol. (For primary document see N77-21591 12-44)

Avail: NTIS HC A99/MF A01

Conceptual study on the process of hydrogen production by direct dissociation of water using high temperature solar energy is described. Calculated result of equilibrium composition of water vapor, hydrogen, and oxygen suggests that temperatures above 3000 K are required for the dissociation of water. Considerations are made on a solar furnace for supplying such high temperature energy. Basic ideas on the method for separating hydrogen and oxygen from high temperature water vapor are suggested. Author

N77-21607# Electrotechnical Lab., Tokyo (Japan).

AN INVESTIGATION OF HYDROGEN PRODUCTION FROM WATER AT HIGH TEMPERATURES

T. Nakamura *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 26 p refs 3 Vol. (For primary document see N77-21591 12-44)

Avail: NTIS HC A99/MF A01

Possibilities of producing hydrogen and oxygen from water at temperatures over 2000 K are investigated. The process of direct thermal decomposition of water is studied using a conceptual model. A two-step thermochemical water decomposition process using alkali-metal and employing the magnetohydrodynamic effect for separating a chemical component in the process is investigated. The alkali-metal process operates, in principle, at relatively low pressures. A two-step thermochemical decomposition process using iron oxide is investigated. Author

N77-21608# New Mexico Univ., Albuquerque.

THERMODYNAMIC ANALYSIS OF ALTERNATE ENERGY CARRIERS, HYDROGEN AND CHEMICAL HEAT PIPES

K. E. Cox, R. H. Carty (Kentucky Univ., Lexington), W. L. Conger (Kentucky Univ., Lexington), M. A. Soliman (Kentucky Univ., Lexington), and J. E. Funk (Kentucky Univ., Lexington) *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 15 p refs Sponsored in part by NASA 3 Vol. (For primary document see N77-21591 12-44)

Avail: NTIS HC A99/MF A01

Hydrogen and chemical heat pipes were proposed as methods of transporting energy from a primary energy source (nuclear, solar) to the user. In the chemical heat pipe system, primary energy is transformed into the energy of a reversible chemical reaction; the chemical species are then transmitted or stored until the energy is required. Analysis of thermochemical hydrogen schemes and chemical heat pipe systems on a second law efficiency or available work basis show that hydrogen is superior especially if the end use of the chemical heat pipe is electrical power. Author

N77-21609# Institute of Gas Technology, Chicago, Ill.

OCEAN THERMAL ENERGY DELIVERY SYSTEMS BASED ON CHEMICAL ENERGY CARRIERS

A. Konopka, A. Talib, N. P. Biederman, and B. Yudow *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 19 p refs 3 Vol. (For primary document see N77-21591 12-44)

(Contract NSF C-1008)

Avail: NTIS HC A99/MF A01

Application of chemical energy carriers to deliver ocean thermal energy is reviewed. The technoeconomic requirements to convert thermal gradient produced shaft power into hydrogen and ammonia are discussed. Subsequent offshore chemical energy transmission and onshore terminal costs and technical requirements are also discussed. A preliminary comparison of hydrogen and ammonia, as ocean thermal energy carriers, is made. Author

N77-21610# Oklahoma State Univ., Stillwater. School of Electrical Engineering.

A WIND ENERGY SYSTEM UTILIZING HIGH PRESSURE ELECTROLYSIS AS A STORAGE MECHANISM

H. Jack Allison *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 13 p refs 3 Vol. (For primary document see N77-21591 12-44)

Avail: NTIS HC A99/MF A01

An energy system which has an input of solar or wind energy must have some mechanism of energy storage if it is to supply reliable power to its consumers. Conventional energy systems which consume hydrocarbons to produce electricity can use energy storage techniques to smooth their power curves to more acceptable levels. The technique of energy storage which utilizes electrolysis cells to dissociate water into its component gases, then stores the evolved hydrogen as a high pressure gas, or as a liquid, or as a hydride, was widely discussed for the past several years. The OSU system is described. Performance parameters for those components of the system which have reached the prototype stage are presented with a discussion of basic problems and economics which must be satisfied before such a system can become practical on a large scale. Author

N77-21611*# Union Carbide Corp., Tonawanda, N.Y. Linde Div.

A STUDY OF THE EFFICIENCY OF HYDROGEN LIQUEFACTION

C. R. Baker and R. L. Shaner *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 25 p refs Sponsored by ERDA 3 Vol. (For primary document see N77-21591 12-44)

(Contract NAS1-13395)

Avail: NTIS HC A99/MF A01

The use of liquid hydrogen as a jet aircraft fuel has a number of environmental and technological advantages over conventional fuels. The liquefaction of hydrogen requires a large expenditure of energy. There are many inefficiencies that are a part of any practical liquefaction process. Current technology was investigated for the best available system. Parametric studies were made to identify where inefficiencies occur and to optimize and integrate the component parts. Flowsheets are presented for a module that produces 250 tons per day of liquid hydrogen. Approximately ten of these modules is needed for a major airport in the 1990's. The advantages of producing a product with a minimum amount of ortho to para hydrogen conversion are pointed out. The optimum degree of conversion was determined for a liquid hydrogen product that will be used within a given time. An assessment was made regarding the potentials for improvement of the processing schemes and equipment over the next 10 to 25 years. Author

N77-21612# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany).

A SYSTEM CONSIDERATION OF THE CRYOGENIC STORAGE TANK FOR LIQUID HYDROGEN FUELED VEHICLES AND THE RESULTING TANK CONCEPT FOR A PASSENGER CAR

W. Peschka and C. Carpetis *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 21 p refs 3 Vol. (For primary document see N77-21591 12-44)

Avail: NTIS HC A99/MF A01

Hydrogen as a replacement for fossile hydrocarbons offers excellent possibilities if an overall hydrogen economy is to be introduced. This depends fundamentally on the development of economic production processes based on thermal or thermoelectrical water splitting using nuclear or solar heat. Within this frame, the use of liquid hydrogen as an alternate fuel will be feasible. Although a number of liquid hydrogen fueled cars were successfully operated, more detailed investigation of the cryogenic

system on board a vehicle is necessary. Some essential parameters are considered in order to optimize the cryogenic system. A compact cryogenic fuel tank for a liquid hydrogen powered vehicle integrated to a unit with the fuel processing system is described. Performance data and test results are given. Author

N77-21613# Southern California Gas Co., Los Angeles.
TECHNICAL AND ENVIRONMENTAL ASPECTS OF UNDERGROUND HYDROGEN STORAGE
A. B. Walters *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 15 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

Underground storage of hydrogen is discussed as the most feasible method of matching hydrogen production sources to variable consumer demands. Environmental impact of underground storage is also presented. B.B.

N77-21614# Energy Research and Development Administration, Washington, D.C.
HYDROGEN STORAGE ON HIGHWAY VEHICLES: UPDATE 1976
E. E. Ecklund and F. L. Kester (Inst. of Gas Technol., Chicago) *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 28 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

The operation and problems in the development of a hydrogen operated internal combustion engine are discussed. Research on several storage techniques is reviewed, and a comparison is made of the total vehicle weights and net fuel utilization efficiencies. B.B.

N77-21615# Technion - Israel Inst. of Tech., Haifa. Dept. of Physics.
HYDROGEN VEHICULAR FUEL STORAGE AS A STEP IN A WATER SPLITTING CYCLE
P. S. Rudman *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 9 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

Hydrogen vehicular refueling is generally conceived of as similar to present-day hydrogen refueling. However, for hydrogen produced in a thermochemical water splitting cycle, a unique refueling cycle is possible. Rather than storing hydrogen, other products of the water splitting cycle are stored, and hydrogen fuel is released by their chemical reaction in situ. Preliminary considerations of the comparative advantages and disadvantages of such a hydrogen refueling system are presented. Author

N77-21616# Virginia Polytechnic Inst. and State Univ., Blacksburg.
HYDROGEN-POWERED HIGHWAY VEHICLES: APPLICATIONS AND OPTIMUM FORM OF FUEL STORAGE
R. L. Whitelaw *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 11 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

Twelve different vehicle applications are considered for the future era of hydrogen as fuel. It is shown that seven different stored energy quantities, from 100,000 to 8,000,000 Btu, will accommodate all. Optimum tank sizes and weights for each are then determined, both for liquid hydrogen at 2 atmos., 23K, and for pressurized hydrogen at 102 atmos., 288K. Liquid hydrogen storage, in well-insulated tankage, is shown to be 1/50th the weight and 1/15th the cost of pressurized gas storage, for the same energy, besides being much safer. Author

N77-21617# California Univ., Los Angeles. School of Engineering and Applied Science.
METHODS OF ON-BOARD GENERATION OF HYDROGEN FOR VEHICULAR USE
A. Z. Ullman and W. D. VanVorst *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 10 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

Possible alternative means of storage of hydrogen, both for use as the sole or major fuel, and as a supplementary fuel for enhancement of the combustion behavior is reviewed. Chemical storage means which may prove more attractive than metal hydrides are presented. Author

N77-21618# Technidyne, Inc., Maspeth, N. Y.
AUTOMOTIVE FUEL SAVING SYSTEM WITH ON-BOARD HYDROGEN GENERATION AND INJECTION INTO IC ENGINES
D. A. Kelly *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 8 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

The automotive fuel saving system with on-board hydrogen generation is advocated as a practical means of reducing automotive gasoline fuel consumption in conventional cars and trucks. The present system is further projected as the forerunner to producing ever higher basic percentages of hydrogen to gasoline mixtures to achieve a relief from constantly increasing gasoline prices. The heart of the system consists of a high efficiency compact electrolysis multi-cell unit which produces the hydrogen gas for injection into the basically unaltered I. C. automotive engine. Author

N77-21619# Brookhaven National Lab., Upton, N.Y.
TITANIUM ALLOY HYDRIDES: THEIR PROPERTIES AND APPLICATIONS
J. J. Reilly and J. R. Johnson *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 25 p refs Sponsored by ERDA 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

Certain reversible metal hydrides were proposed as energy storage media. One of these, titanium iron hydride, has already been used as a pilot scale demonstration for this purpose. Formation and properties of other titanium alloy hydrides which are also of interest are discussed. Particular emphasis is given to the class of ternary alloys having composition corresponding to TiFe sub x M sub y where M is a transition metal. It was determined that many alloys of this type react directly and reversibly with hydrogen to form hydrides. The properties of these hydrides vary and are dependent on the particular transition metal substitute and its quantity. The integration of such materials with energy storage systems and their relative advantages are also discussed. Author

N77-21620# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerperforschung.
PHYSICAL METALLURGY OF FeTi-HYDRIDE AND ITS BEHAVIOR IN A HYDROGEN STORAGE CONTAINER
M. A. Pick and H. Wenzel *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 13 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

FeTi samples were prepared and characterized by metallography, X-ray diffraction, neutron diffraction and specific heat measurements. The conditions for the presence of the ordered CsCl structure at room temperature were investigated. This material was used to study FeTi hydrides, especially the structure, phase transition, and the heat of reaction as a function of the hydrogen concentration. The FeTi material was used to build and operate a small hydrogen storage container as an alternative to high pressure hydrogen gas containers. Author

N77-21621# Brookhaven National Lab., Upton, N.Y.
THE BEHAVIOR OF IRON TITANIUM HYDRIDE TEST BEDS: LONG-TERM EFFECTS, HEAT TRANSFER AND MODELING
G. Strickland, J. Milau, and W.-S. Yu *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 31 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

Several types of studies were made with test beds of iron titanium hydride in order to determine their long-term and thermal behavior. This material provides a way of storing hydrogen in relatively dense form at ordinary temperatures and moderate pressures. Its use offers electrical utilities a way of storing low cost off peak power, to meet costly peak shaving needs, in combination with an electrolyzer and a fuel cell stack. The data

obtained is part of that needed for the design of plant scale hydride reservoirs. Accelerated cyclic tests were made with 1-in. diameter test beds to determine changes in their long term behavior, the main result being extensive particle attrition. The thermal behavior of a 6-in. diameter test bed was determined along with the times that various hydrogen flow rates could be sustained during hydriding and dehydriding. Author

N77-21622# Argonne National Lab., Ill.
A THERMODYNAMIC ANALYSIS OF HYCSOS, A HYDROGEN CONVERSION AND STORAGE SYSTEM
Dieter M. Gruen, Felix Schreiner, and Irving Sheft *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 15 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

A two metal hydride system for the storage, retrieval, and conversion of thermal energy is described. The system functions heating, cooling, and power production are discussed for solar energy applications. A thermodynamic analysis particularly of the conversion cycle is presented. It is concluded that solar concentrators providing heat transfer fluid temperatures of 140 deg could give conversion efficiencies of 16.5 percent. Author

N77-21623# Monsanto Research Corp., Miamisburg, Ohio.
NMR STUDIES OF STRUCTURE AND DIFFUSION IN METAL HYDRIDES
R. C. Bowman, Jr., A. Attalla, and W. E. Tadlock *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 13 p refs 3 Vol. (For primary document see N77-21591 12-44)
Avail: NTIS HC A99/MF A01

Various pulse nuclear magnetic resonance (NMR) techniques were used to determine the proton lineshapes and nuclear relaxation times in metal hydrides. Analysis of the NMR data provide information on the nature of the lattice sites occupied by protons and on the hydrogen diffusion parameters. The effects of hydrogen concentration and temperature on hydrogen diffusion in vanadium hydride were investigated. NMR measurements were also performed on the two iron-titanium (FeTi) hydride phases. The implications of NMR studies on the general behavior of metal hydrides as hydrogen storage materials are briefly discussed. Author

N77-21624*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A SIMPLE APPROACH TO METAL HYDRIDE ALLOY OPTIMIZATION
Daniel D. Lawson, Charles Miller, and Robert F. Landel *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 9 p refs 3 Vol. (For primary document see N77-21591 12-44)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01

Certain metals and related alloys can combine with hydrogen in a reversible fashion, so that on being heated, they release a portion of the gas. Such materials may find application in the large scale storage of hydrogen. Metal and alloys which show high dissociation pressure at low temperatures, and low endothermic heat of dissociation, and are therefore desirable for hydrogen storage, give values of the Hildebrand-Scott solubility parameter that lie between 100-118 Hildebrands, (Ref. 1), close to that of dissociated hydrogen. All of the less practical storage systems give much lower values of the solubility parameter. By using the Hildebrand solubility parameter as a criterion, and applying the mixing rule to combinations of known alloys and solid solutions, correlations are made to optimize alloy compositions and maximize hydrogen storage capacity. Author

N77-21625# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
SELECTION OF STRUCTURAL MATERIALS FOR HYDROGEN PIPELINES AND STORAGE VESSELS
Anthony W. Thompson and I. M. Bernstein (Carnegie-Mellon Univ.) *In* Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 Mar. 1976 19 p refs 3 Vol. (For primary document see N77-21591 12-44)
(Contract N00014-75-C-0265)
Avail: NTIS HC A99/MF A01

Criteria for identification of unsuitable materials, as well as the selection of improved materials for new installations is discussed. The potential dangers of using unsuitable materials are briefly illustrated, using documented examples of pipeline and storage facility failures. The feasibility, both of using present transmission lines for hydrogen, and of developing steels resistant to hydrogen is explored. Author

N77-21626# Miami Univ., Coral Gables, Fla. Clean Energy Research Inst.
FIRST WORLD HYDROGEN ENERGY CONFERENCE PROCEEDINGS, VOLUME 3
T. Nejat Veziroglu, ed. Mar. 1976 646 p refs Proc. held at Miami Beach, Fla., 1-3 Mar. 1976 Sponsored by ERDA 3 Vol.
Avail: NTIS HC A99/MF A01

The use of hydrogen energy and its impact on the economy are discussed. The thermodynamic characteristics and efficiency of hydrogen and liquid hydrogen fuels in aircraft and internal combustion automobile engines are investigated. Industrial, commercial, and residential applications are also explored. For individual titles, see N77-21627 through N77-21665.

N77-21627*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE THERMAL EFFICIENCY AND COST OF PRODUCING HYDROGEN AND OTHER SYNTHETIC AIRCRAFT FUELS FROM COAL
Robert D. Witcofski *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 28 p refs 3 Vol. (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

A comparison is made of the cost and thermal efficiency of producing liquid hydrogen, liquid methane and synthetic aviation kerosene from coal. These results are combined with estimates of the cost and energy losses associated with transporting, storing, and transferring the fuels to aircraft. The results of hydrogen-fueled and kerosene-fueled aircraft performance studies are utilized to compare the economic viability and efficiency of coal resource utilization of synthetic aviation fuels. Author

N77-21628*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME EARLY PERSPECTIVES ON GROUND REQUIREMENTS OF LIQUID HYDROGEN AIR TRANSPORTS
Peter F. Korycinski *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 24 p refs 3 Vol. (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

The introduction of liquid hydrogen as a fuel for large, long haul air transports requires an integrated approach involving the air terminal authorities and the liquid hydrogen suppliers, as well as the airline operators and the air transport manufacturers. To illustrate the scope of the requirements necessary to support large air transports at the air terminals, perspectives are drawn to surface some concerns each of the principals may have to face, and to identify those that will require cooperative efforts to obtain integrated solutions. Author

N77-21629*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NEW POTENTIALS FOR CONVENTIONAL AIRCRAFT WHEN POWERED BY HYDROGEN-ENRICHED GASOLINE
W. A. Menard, P. I. Moynihan, and J. H. Rupe *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 28 p refs 3 Vol. (For primary document see N77-21626 12-44)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01

Overall system efficiency and performance of a Beech Model 20 Duke aircraft was studied to provide analytical representations of an aircraft piston engine system, including all essential components required for onboard hydrogen generation. Lower emission levels and a 20% reduction in fuel consumption may be obtained by using a catalytic hydrogen generator, incorporated as part of the air induction system, to generate hydrogen by breaking down small amounts of the aviation gasoline used in the normal propulsion system. This hydrogen is then mixed with gasoline and compressed air from the turbocharger before entering the engine combustion chamber. The special

properties of the hydrogen-enriched gasoline allow the engine to operate at ultra lean fuel/air ratios, resulting in higher efficiencies. Author

N77-21630# Boeing Commercial Airplane Co., Seattle, Wash.
FUEL SUBSYSTEM CHARACTERISTICS FOR LH2 AIRCRAFT
A. M. Momenthy *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 16 p 3 Vol. (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

Design characteristics of the fuel subsystem for subsonic LH2 fueled commercial aircraft are discussed in terms of requirements and technology availability. Some of the differences between LH2 systems developed for space vehicles and those required for commercial aircraft are pointed out. Significant areas of technology requiring advancement and long lead time development testing are identified. Results obtained from a Boeing study covering the development of a candidate fuel subsystem for a 3,000 nautical mile range LH2 fueled commercial airplane are included. Author

N77-21631# Billings Energy Research Corp., Provo, Utah.
WATER INDUCTION IN HYDROGEN-POWERED IC ENGINES
R. L. Woolley and D. L. Henriksen *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 23 p refs 3 Vol. (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

Addition of water to the hydrogen-air mixture in the intake manifold is an effective means of both suppressing the tendency to backflash and reducing the production of oxides of nitrogen. Tests are run on a Dodge 440 CID V8 engine having a compression ratio of 12 to 1. Dramatic reduction in oxides of nitrogen is observed as the water flow is increased, yet essentially no change is observed in either power or efficiency. Exhaust temperature, nitrogen oxide, and equivalence ratio is measured at each exhaust valve. It is found that a large cylinder to cylinder variation in nitrogen oxide production is caused by slight non-uniformity in mixing of the hydrogen-air streams. It is further shown that nitrogen oxide production is an exponential function of equivalence ratio, water to hydrogen mass ratio, and engine speed. Author

N77-21632# Musashi Inst. of Tech., Tokyo (Japan).
DEVELOPMENT OF A LIQUID HYDROGEN CAR
S. Furuhama, M. Hiruma, and Y. Enomoto *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol 3 Mar. 1976 32 p refs 3 Vol. (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

A liquid hydrogen tank with a capacity of 230 liters (61 gal.) at 5 atm/g (71 psi.g) pressure was installed in a Datsun B210 passenger car having a 1.4 liter displacement engine. Because the lower temperature hydrogen gas introduces better performance in the engine, fuel was lead from the rear tank to the front engine through a vacuum insulated pipe and injected into the intake port by a mechanical valve. The performance of the car in a 2,800 km (1730 mi) rally is evaluated as regards energy economy, emission, and safety. Author

N77-21633# Billings Energy Research Corp., Provo, Utah. Hydrogen Engine Research.
DYNAMIC TESTS OF HYDROGEN-POWERED IC ENGINES
R. L. Woolley and G. J. Germane (Brigham Young Univ.) *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 16 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

A speed governed, sawtooth, torque time cycle was used in checkout and calibration of computer controlled engine test cells. This cycle makes possible comparison of integrated steady-state data with dynamic test results. Integration of available data indicates that a factor of 1.5 (50% improvement) is a valid number for estimation of hydrogen engine efficiency from a knowledge of gasoline efficiency. Vehicle driving dynamics for a transit vehicle are simulated for a simplified road cycle. An example calculation indicates that the efficiency penalty resulting from the addition of a 4,000 lb metal hydride tank is more than offset by efficiency benefits in the hydrogen engine. The energy savings with a heavier, hydrogen-powered transit vehicle was predicted to be nearly 30%. Author

N77-21634# Idaho National Engineering Lab., Idaho Falls.
MODIFICATION TECHNIQUES AND PERFORMANCE CHARACTERISTICS OF HYDROGEN-POWERED IC ENGINES: STATE OF THE ART, 1975
F. B. Simpson, J. H. Lofthouse, D. R. Swope, and R. L. Woolley (Billings Energy Research Corp.) *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 22 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

Developments in hydrogen-powered engine technology are summarized. Topics reviewed include: engine parameters, modifications, operating conditions, running characteristics, and performance. The cost for manpower and materials associated with the modification of one engine is discussed. Author

N77-21635# California Univ., Los Angeles.
CRASH TEST OF A LIQUID HYDROGEN AUTOMOBILE
J. G. Finegold and W. D. VanVorst *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 13 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

Details of the conversion of a U.S. Postal Service mail truck to hydrogen-fueled operation are given. Specific reference is made to design safety considerations. A traffic accident is described that caused the mail truck (mounted on a trailer) to turn on its side at approximately 20 mph and to finally slide to a stop and turn upside down. No one was injured, and there was essentially no damage to the liquid hydrogen fuel system. The mail truck was driven away from the scene of the accident. Suggestions to insure the safety of hydrogen-fueled experimental vehicles are made. Author

N77-21636# Billings Energy Research Corp., Provo, Utah.
PROTOTYPE HYDROGEN AUTOMOBILE USING A METAL HYDRIDE
D. L. Henriksen, D. B. Mackay, and V. R. Anderson *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 12 p (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

A 1975 Pontiac Grand Ville was converted to run on hydrogen. Engine conversion, the design of the iron-titanium storage system, and the design of related controls and safety equipment are discussed. Engine modifications include increase in compression ratio, conversion of the carburetor for water induction, and changes in the ignition system. Power control is obtained by throttling the air-hydrogen mixture. Waste heat from the engine exhaust is circulated through the hydride tank to drive off hydrogen. Controls are provided for regulating waste heat and hydrogen pressure. The method for recharging the system is also described. Author

N77-21637# Billings Energy Research Corp., Provo, Utah.
AUTOMOTIVE HYDRIDE TANK DESIGN
Donald B. Mackay *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 11 p (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

Automotive hydride tanks must be designed as both pressure vessels and heat exchangers. Hydride heat transfer properties are presented using heat exchange data and results from theoretical investigations and prototype testing. Discussion of promising designs and directions for future activity are included. Tabular designs which avoid many previously encountered difficulties are analyzed. Author

N77-21638# Billings Energy Research Corp., Provo, Utah.
A HYDROGEN-POWERED MASS TRANSIT SYSTEM
Roger E. Billings *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 14 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

Hydrogen's application to mass transit systems is considered. A 21-passenger bus is converted to hydrogen using a Dodge engine which has been modified for high compression

operation. Backfiring and nitric oxide pollution formation are controlled by a water injection technique. Hydrogen fuel storage for the experimental prototype is accomplished by two metal hydride containers using an iron-titanium alloy. Data are presented regarding equipment conversion and design, energy resource utilization, economics, and safety. Author

N77-21639# Roorkee Univ. (India).
USE OF HYDROGEN IN AUTOMOTIVE ENGINES
C. P. Gupta *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 25 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

The case of hydrogen as automotive engine fuel is discussed in the context of environment pollution and scarcity of hydrocarbon fuels. The development of the air-breathing, hydrogen IC engine is reviewed. The hydrogen-oxygen high temperature cycle power plant for automotive applications is also examined. Various methods of storing hydrogen on automotive vehicles are discussed and the resulting vehicle weights and ranges compared. The production, transportation, storage and distribution of hydrogen are briefly considered. Author

N77-21640# Los Alamos Scientific Lab., N. Mex.
HYDROGEN SAFETY PROBLEMS
R. Reider and F. J. Edeskuty *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 7 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

Consideration of the use of hydrogen as a common fuel is presented. Questions on the matter of safety were raised, and techniques in the field of accident prevention are mentioned. B.B.

N77-21641# Institute of Gas Technology, Chicago, Ill. IIT Center.
COMMODITY HYDROGEN FROM OFF-PEAK ELECTRICITY
K. Darrow, N. Biederman, and A. Konopka *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 29 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

The use of off peak electrical power as an energy source for the electrolytic production of hydrogen is considered. The present industrial uses for hydrogen are examined to determine if hydrogen produced in this fashion is competitive with the industry's onsite production or existing hydrogen prices. A technical and economic feasibility analysis of the various components required and of the operation of the system as a whole including production, transmission, storage, and markets is presented. Author

N77-21642# Institute of Gas Technology, Chicago, Ill.
TECHNICAL PROSPECTS FOR COMMERCIAL AND RESIDENTIAL DISTRIBUTION AND UTILIZATION OF HYDROGEN
J. Pangborn, M. Scott, and J. Sharer *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 27 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

Hydrogen was suggested as a fuel gas to eventually replace natural gas in commercial and residential heating and cooking applications. After transmission from a production site to a city gate, the delivery of hydrogen would be through the pipelines of conventional (natural gas) distribution systems. It is combusted in appliances with suitably modified burners. Technical assessments for the distribution and utilization of hydrogen were assembled. Author

N77-21643*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENERGY STORAGE POSSIBILITIES OF ATOMIC HYDROGEN
R. D. Etters (Colorado State Univ., Ft. Collins), J. V. Dugan, Jr. (Science and Tech. Comm., Washington, D. C.), and R. Palmer *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 18 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

Several recent experiments designed to produce and store macroscopic quantities of atomic hydrogen are discussed. The bulk, ground state properties of atomic hydrogen, deuterium, and tritium systems are calculated assuming that all pair interactions occur via the atomic triplet potential. The conditions required to obtain this system, including inhibition of recombination through the energetically favorable singlet interaction, are discussed. The internal energy, pressure, and compressibility are calculated applying the Monte Carlo technique with a quantum mechanical variational wavefunction. The system studied consisted of 32 atoms in a box with periodic boundary conditions. Results show that atomic triplet hydrogen and deuterium remain gaseous at 0 K; i.e., the internal energy is positive at all molar volumes considered. Author

N77-21644# Ayra Mehr Univ. of Technology, Tehran (Iran).
AN EXAMINATION OF THE STIRRED REACTOR AS A TOOL FOR THE DETERMINATION OF RATE CONSTANTS OF THE H2-O2 COMBUSTION REACTIONS
M. Rashidi and G. A. Karim *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 16 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

An investigation into the uncertainty in the deduced rate constants of H2-O2 reactions resulting from measurement and interpretation errors associated with the stirred reactor apparatus is described. It is suggested that the interpretation and measurement of reactor temperature and heat transfer contributed to the highest uncertainty in the deduced rate constants, while the measurement of equivalence ratio, loading and inlet gas temperature was comparatively less important. By considering uncertainties in the measurements for two reactor operating conditions, it was shown that the rate constants for three elementary reactions can be adjusted successfully. Author

N77-21645# Calgary Univ. (Alberta).
A CONSIDERATION OF CATALYTIC EFFECTS ON Pt-Pt/Rh THERMOCOUPLES IN COMBUSTION SYSTEMS INVOLVING HYDROGEN AS A FUEL
G. A. Karim, M. D. DSouza, S. L. Khanna, and M. Rashidi *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 6 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

Sources of error in relation to combustion systems are discussed. Work relating to the serious errors associated with catalytic effects involving the widely used Pt-Pt/Rh thermocouples in combustion systems using hydrogen as a fuel is considered in detail. It is then suggested that the sheathing of the thermocouple junction by a very thin quartz tubing offers the most effective remedy for this error. Author

N77-21646# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany).
ON THE STORAGE OF HYDROGEN BY USE OF CRYO-ADSORBENTS
C. Carpetis and W. Peschka *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 10 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

Besides economical production methods it is necessary for a future hydrogen economy to assure storage systems for large quantities of hydrogen. The storage method considered is based on the use of adsorbent materials at cryogenic temperatures (liquid nitrogen range) and at pressures up to 60 bar. The adsorption capability of several materials under these conditions enables hydrogen storage densities comparable to the density of liquid hydrogen. The storage efficiency is estimated, and suggestions are made for the increase of the storage efficiency by means of regenerative heat storage. Research topics necessary for detailed system component design and economic evaluation are outlined. Author

N77-21647# Cornell Univ., Ithaca, N.Y. Sibley School of Mechanical and Aerospace Engineering.
RECIPROCATING PUMP FOR CONVERSION OF LIQUID HYDROGEN TO HIGH PRESSURE GASEOUS HYDROGEN
J. S. Meserole, Jr. and P. C. T. DeBoer *In* Miami Univ. First World

Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 15 p refs Sponsored in part by DOT and NSF (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

The design, construction and testing of a reciprocating device are presented. The device uses two pistons of different diameter on a common shaft. The small piston compresses the liquid hydrogen, which is then gasified by passing it through a heat exchanger. Part of the resulting mechanical work is used to drive the larger piston. The hydrogen flow is governed by a suitable valving arrangement, controlled by magnetic position sensors together with an electronic logic network. A brief thermodynamic analysis is presented of the expander cycle on which the device is based. The prototype built was tested with liquid nitrogen. Various sealing and design considerations are discussed, as are possibilities for future improvements. The device has potential application for relatively small scale uses of high pressure hydrogen, such as in vehicles incorporating direct cylinder injection. Author

N77-21648# California Univ., Livermore. Lawrence Livermore Lab.
HYDROGEN ENERGY: ITS POTENTIAL PROMISES AND PROBLEMS
G. D. Sauter *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 1 Mar. 1976 8 p (For primary document see N77-21626 12-44)
(Contract W-7405-eng-48)
Avail: NTIS HC A99/MF A01

The author's opinions regarding the potential promises and problems of hydrogen energy are presented. Author

N77-21649# Miami Univ., Coral Gables, Fla.
ANALYSIS OF A DELPHI STUDY ON HYDROGEN
P. Valette, L. Valette, and M. Siebker *In its* First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 14 p (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

Different technical and economical features and the consumption of hydrogen in 1985 and 2000 are presented. Most of these features have been investigated for the first time in a comprehensive forecasting effort. Author

N77-21650# Energy Research and Development Administration, Washington, D.C.
ERDA'S HYDROGEN PROGRAMS
Albert R. Landgrebe *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 17 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

A brief overview of ERDA's Research and Development activities related to hydrogen technology, as well as some possible future directions in which this technology may lead us are given. Author

N77-21651*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE NASA HYDROGEN ENERGY SYSTEMS TECHNOLOGY STUDY: A SUMMARY
E. A. Laumann *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 15 p refs (For primary document see N77-21626 12-44)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01

The results and conclusions of the study, which found a significant current usage of hydrogen, dominated by chemical-industry needs and supplied mostly from natural gas and petroleum feedstocks are discussed. These needs are expected to increase significantly in the remainder of this century and to largely outgrow the current means of supply. Several hydrogen production methods were evaluated. Those not dependent on fossil resources were found to be presently more costly and technically more difficult than fossil-feedstock-based technologies, but it is clear that they will eventually need to be implemented. Author

N77-21652# Michigan Univ., Ann Arbor.
PERSPECTIVES ON THE EVOLUTION INTO A HYDROGEN ECONOMY
L. W. Jones *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 9 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

The optimal trajectory of patterns in energy metabolism over the next fifty years is explored in the context of desirable goals and evolutionary strategies. It is argued that we must ultimately develop a totally cyclic energy economy in which hydrogen plays a prominent role, and that progress towards that end point is most efficiently achieved without extensive excursions into technological blind alleys. The conclusion is reached that apparent short-term non-optimal solutions where hydrogen is introduced early may in fact be the most economical in the long term. Author

N77-21653# Stanford Research Inst., Menlo Park, Calif.
TECHNOLOGY IMPACT ASSESSMENT OF THE HYDROGEN ECONOMY CONCEPT: KEY FINDINGS
E. M. Dickson *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 12 p refs Sponsored by NSF (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

Key findings of technology impact assessment of the hydrogen economy concept are presented. The manner in which the standard business practice of evaluating alternative investments in terms of a discounted future works to hydrogen's disadvantage is discussed. The effects of neutral-, pro-, and anti-hydrogen federal energy policies are outlined. A prioritized list of R&D requirements that will ensure the continued development of an appropriate data base about hydrogen for use in formulating federal energy policy is given. Author

N77-21654# California Univ., Livermore. Lawrence Livermore Lab.
WILL THE LARGE-SCALE PRODUCTION OF HYDROGEN BE PART OF THE ENERGY PROBLEM OR PART OF ITS SOLUTION?
G. D. Sauter *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 16 p refs (For primary document see N77-21626 12-44)
(Contract W-7405-eng-48)
Avail: NTIS HC A99/MF A01

The energy dynamics of nuclear reactors as a means of generating hydrogen, the rate of expansion of the reactor network and the ratio of the energy required to build a reactor to the energy it produces are analyzed. A specific scenario--the development by the year 2000 of the capacity to generate annually the amount of hydrogen which has the heat content of the natural gas consumed in the U.S. in 1970--is examined. For this scenario, it appears that the reactors, rather than the hydrogen, will be the energy storage mechanism. Author

N77-21655# Brown, Boveri & Cie Aktiengesellschaft, Baden (Switzerland).
THE GREENLAND HYDROPOWER AS A SOURCE OF ELECTROLYTIC HYDROGEN
U. LaRoche *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 10 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

A preliminary assessment of the Greenland hydropower potential, which appears to reach size of between 100 GW to 1 TW ultimately recoverable annual mean output at electricity costs well comparable with nuclear off-peak power ratings, is presented. This potential has similar characteristics to mineral and fossil fuel resources in so far as it may best be described by indicating different categories of assuredness (proven, reasonably assured, ultimately recoverable). Besides energy needed in Greenland itself a major energy exportation appears completely feasible. One of the best solutions is shown to be the well known project energy depot concept, namely in situ synthesis of ammonia on the basis of liquefied air and electrolytic hydrogen. This then will be transported by LNG-tankers in liquid form overseas. Expected costs indicate a market penetration capability to be considered seriously. Author

N77-21656# Oceanic Inst., Waimanalo, Hawaii.
HYDROGEN IN THE SEAWARD ADVANCEMENT OF INDUSTRIAL SOCIETIES

J. A. Hanson *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 12 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

The feasibility of offshore urban/industrial complexes, as future development, is investigated. They could thus serve as test and demonstration beds for the eventual adoption of hydrogen as the storable, transportable and ecologically sound fuel base of highly efficient urban/industrial complexes everywhere. Author

N77-21657# Florida International Univ., Miami.
ENERGY AND THE FUTURE
T. Gonen, P. M. Anderson (EPRI), and D. W. Bowen (MAPP Coordination Center, Minneapolis) *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 24 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

The entire energy field is covered, with special emphasis on electric power. The causes of the current and the future energy problem and, projected energy demand to the year 2000 on the basis of statistical data are reviewed, and a survey of U.S. energy forecasts are made in order to make a comparison between the projections. Some energy-related issues are discussed in light of the projections. Author

N77-21658*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HYDROGEN USE PROJECTIONS AND SUPPLY OPTIONS
R. Manvi and T. Fujita *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 25 p refs (For primary document see N77-21626 12-44)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01

Reference and expanded use projections were developed to estimate future hydrogen demand. The rationale in the development of these projections, which estimate the growth of hydrogen usage of approximately 1 X 10 to the fifteenth power Btu in 1973 to approximately 5.5 X 10 to the fifteenth power for reference use and 22 X 10 to the fifteenth power Btu for expanded use projections in year 2000. Primary energy sources required to produce these demands are discussed in the light of transition from a low merchant to high merchant supply option. Author

N77-21659# Miami Univ., Coral Gables, Fla.
ECONOMICS OF NUCLEAR - ELECTROLYTIC HYDROGEN
S. Kakac and T. N. Keziroglu *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 19 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

The economic status of nuclear energy is discussed; in this connection, the economic comparison of two power plants, namely coal-fired and nuclear power plants, is given. The production of hydrogen from nuclear energy with the method of water electrolysis is discussed. The economics of nuclear-electrolytic hydrogen transmitting to a large distance from the plant are considered. The importance of hydrogen as an energy storage element is indicated. Author

N77-21660# Special Studies Group TNO, Apeldoorn (Netherlands).
HYDROGEN IN THE ENERGY SYSTEM OF THE NETHERLANDS
A. J. Bogers and W. VanDeelan *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 19 p (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

The optimization of a hydrogen using energy system and the problem of the production of hydrogen are discussed. It will be argued that the process of electrolysis will be preferable to the thermochemical method, not only for reasons of cost, but also because of safety and reliability aspects, while also the purity of the gas produced, having consequences for the possibilities of both fuel cells and catalytic combustion, can be seen as an advantage. Author

N77-21661# Harvard Univ., Cambridge, Mass. John Fitzgerald Kennedy School of Government.
US OPTIONS FOR A TRANSITION FROM OIL AND GAS TO SYNTHETIC FUELS
A. S. Manne *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 8 p (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

Some of the options by which the U.S. may move away from its present heavy dependence upon oil and gas toward a more diversified energy economy are discussed. Through nonlinear programming, the model incorporates both own- and cross-price elasticities of demand. In this way, it allows for price-induced interfuel substitution and energy conservation. Among the supply options studied are: (1) direct combustion of coal to generate electricity, (2) conversion of coal to synthetic fuels, (3) nuclear energy - first from the light water reactor and later from the fast breeder, (4) hydrogen via an efficient production process; and (5) distant future technical options such as fusion and central station solar power (aggregated together and described only as an advanced technology). Author

N77-21662# Miami Univ., Coral Gables, Fla.
A SIMPLIFIED EQUILIBRIUM MODEL OF THE US ENERGY-ECONOMIC SYSTEM AND ITS USE IN COMPARING ALTERNATIVES
H. J. Plass, Jr. *In its* First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 24 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

A simplified model of the U.S. energy-economic system is developed using published data on energy flows, labor employed, and dollar flows. The energy system, usually divided into the sectors of industry, electric power, residential-commercial, and transportation, is restructured into a three-sector model including extraction and production of energy resources, production of goods and services, and consumption of fuels, goods and services. Effects on fuel used, employment, and standard of living of various alternatives are examined, including high prices of imported fuel, technological improvements, solar energy for space and water heating, and hydrogen fuel for transportation. Author

N77-21663# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
HYDROGEN ECONOMY ANALYSIS USING DECISION THEORY
Rasin Georgescu *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 14 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

Several articles and different studies reveal the increasing interest in hydrogen as a nonpolluting multipurpose fuel. The problem of the development of the research and the adoption of the best solution for the main problems of hydrogen economy is very actual for each country. The possibilities offered by the decision theory to analyze and adopt the best decision to introduce, organize and develop a hydrogen economy are investigated. An example of the utilization of the decision theory in the analysis of a set of strategies concerned with the structure of the hydrogen economy is presented. Author

N77-21664# Southampton Univ. (England).
POSSIBLE POLLUTION AND COST ANALYSIS FROM WIDE USE OF HYDROGEN FUEL IN TRANSPORTATION
S. P. Chakravarty and K. S. Varde (Michigan Univ., Dearborn) *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 13 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

The potential of hydrogen as a fuel for powerplants used in highway vehicles is investigated from the point of pollution, efficiency of the powerplant and the cost of using hydrogen on a wide scale. It is found that hydrogen will be a good competitor against present fuels with respect to vehicle performance. The potential of hydrogen from cost point is difficult to determine readily; it requires knowledge of inter-industry exchanges involved in hydrogen production by various techniques and the effect of future cost of petroleum fuel. An approach is set-up to predict cost of producing hydrogen; the approach requires that various data be fed into the model which can be developed with this approach. The output of the model study can be used to make a decision about belting on hydrogen fuel. Author

N77-21665# Papanicolaou Cancer Research Inst., Riverside, Calif.
OPERATION COUGH DROP
R. M. Zweig *In* Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 Mar. 1976 11 p refs (For primary document see N77-21626 12-44)
Avail: NTIS HC A99/MF A01

A review of air pollution trends and health effects is presented, comparing data from the United Kingdom and the United States. An outline of chemical analysis of pollutants is given, and a description of an increased incidence of various disease entities resulting from these chemical toxins is analyzed. In-depth analysis of the pollution in the eastern zone of the south coast air basin of California is presented, along with a projection of pollution trends in this same area, utilizing hydrogen as a fuel for vehicular and stationary sources. A working model for this strategy is described, utilizing the city of Riverside, California as the site for implementing the Hydrogen Economy. Author

N77-21666*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
OCEAN THERMAL PLANT Patent Application
Lester J. Owens, inventor (to NASA) Filed 29 Mar. 1977 18 p
(NASA-Case-KSC-11034-1; US-Patent-Appl-SN-782481) Avail: NTIS HC A02/MF A01 CSCL 10A

An ocean thermal plant consisting of a floating energy converter utilizing large volumes of sea water to produce electrical power is described. In this plant, a fluid working medium is pumped to an evaporator where it is heated by a flow of warm surface sea water. The fluid in liquid form boils to a pressurized gas vapor which is routed to drive a turbine that, in turn, drives a generator for producing electricity. The gas vapor then enters a condenser immersed in cold sea water pumped from lower depths. The gas vapor condenses to its original liquid form and is then pumped to the evaporator to repeat the cycle. Modular components can be readily interchanged on the ocean thermal unit, and inlet pipes for the sea water are provided with means for maintaining the pipes in alignment with the oncoming current. The modular construction allows for the testing of various components to provide a more rapid optimization of a standardized plant. NASA

N77-21667# Sandia Labs., Albuquerque, N.Mex.
PREDICTING WIND POWER AT TURBINE LEVEL FROM AN ANEMOMETER RECORD AT ARBITRARY HEIGHT
Jack W. Reed 1976 10 p refs Presented at Intern. Symp. on Wind Energy Systems, Cambridge, England, 7 Sep. 1976
(Contract AT(29-1)-789)
(SAND-76-5397; Conf-760909-1) Avail: NTIS HC A02/MF A01

Wind speed variation with height in the frictional boundary layer depends on wind speed, surface roughness and thermodynamic stability. Over relatively flat terrain, suitable for extensive fields of wind energy extractors, useful wind increases in proportion to the one-seventh power of height above ground. This closely approximates the more general and theoretically based logarithmic model above standard 10 meter anemometer height and with the 0.03m roughness length often found by observation. Several data collections have been assembled to verify the utility of this one-seventh power law, from special meteorological research towers as well as long-term records from regular weather stations where the anemometer happened to be moved on occasion. A minor correction for lower speeds of 2-8m/s improves predictions but is not essential to gross power availability calculations for large turbine blades. ERA

N77-21668# Martin Marietta Corp., Denver, Colo.
CENTRAL RECEIVER SOLAR THERMAL POWER SYSTEM, PHASE 1 Quarterly Progress Report, period ending 30 Jun. 1976
Jul. 1976 128 p
(Contract E(04-3)-1110)
(SAN/1110-76/T2) Avail: NTIS HC A07/MF A01

The major program activities were aimed toward the fabrication of the three major research experiments and continued evaluation of the pilot plant performance and operating modes. The detail designs were completed. Both warm and hot starts from thermal storage were evaluated as was a cold start from the receiver. In the collector subsystem experiment the heliostat structures and drive mechanisms were completed and delivered. The sensor and associated electronics for the first heliostat were completed as were installation and checkout of the PDP-11 computer and control console for the entire collector experiment. The first twenty-five mirror heliostat was erected and was operational. The detail design of the 5 MW receiver experiment was completed. In the thermal storage subsystem the detail design of the experiment was completed early in the period. A final selection of the heat transport media was made with Hitec selected as the molten salt and Caloria HT-43 selected as the hydrocarbon oil. GRA

N77-21669# DSS Engineers, Inc., Fort Lauderdale, Fla.
PRELIMINARY RESEARCH ON OCEAN ENERGY INDUSTRIAL COMPLEXES, PHASE 1
C. D. Hornburg, B. Lindal, and N. Elramly Apr. 1976 342 p refs
(Contract E(40-1)-4915)
(ORO-4915-3) Avail: NTIS HC A15/MF A01

A preliminary market analysis covering 30 possible energy intensive products classified 12 as high demand, high growth rate. Costs of shipping bulk solids and liquids to and from the ocean site will amount to 1 to 5 percent of the product sales price. A total of 25 individual plants or processes are analyzed. The main process selected for concentration and crystallization in the sea chemicals complex was the freezing process. The main process used in the organic chemicals and plastic complex is the electric arc process. Ammonia will be produced from by-product hydrogen. Detailed capital and operating cost information is presented. It was concluded that producing energy intensive products at integrated OEICs is technically sound and economically viable. ERA

N77-21670# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
DESIGN, CONSTRUCTION, AND TESTING OF A RESIDENTIAL SOLAR HEATING AND COOLING SYSTEM
Dan S. Ward and George O. G. Loef Jun. 1976 113 p Prepared for the NATO Committee on the Challenges of Modern Society
(Contract E(11-1)-2577)
(COO-2577-10) Avail: NTIS HC A06/MF A01

The NSF/CSU Solar House I solar heating and cooling system became operational on 1 July 1974. The results of one full year of operation of the house are analyzed. ERA

N77-21671# California Univ., Berkeley. Lawrence Berkeley Lab.
COVERED ENERGY FARMS FOR SOLAR ENERGY CONVERSION
James A. Bassham Apr. 1976 20 p Presented at Conf. on Capturing the Sun Through Bioconversion, Washington, D. C., 10 Mar. 1976
(Contract W-7405-eng-48)
(LBL-4844; Conf-760354-1) Avail: NTIS HC A02/MF A01

The reasons for the low efficiency of solar energy conversion in plants are described in order to clarify the economic factors affecting the development of biomass on energy plantations. A proposal is made for an energy plantation in the desert covered with inflatable plastics to prevent water loss. The crop suggested is alfalfa as it can be harvested ten or twelve times a year, and a very high nutritional value protein can be extracted from the leaves by pressing. The residue would be burned to generate electricity. The combined profits from the sale of protein and from the sale of electricity might make this concept economically feasible in a society with expensive energy and food. ERA

N77-21672# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
EVALUATING AEROSHELL MATERIALS FOR THE MJS/MULTI-HUNDRED WATT HEAT SOURCE
G. L. Bennett, J. C. Hagan, and D. C. Tantino Jul. 1976 46 p refs
(Contract E(49-15)-3060)
(ANSP-M-14; DNRA-3060-014) Avail: NTIS HC A03/MF A01

In order to evaluate the possibility of improving upon an

existing aeroshell design for the multi-hundred watt power source, a tradeoff study was conducted on a variety of candidate aeroshell materials. Mariner Jupiter/Saturn mission requirements and aeroshell material criteria were established to form a basis for the evaluation. Material data searches and reentry analyses were made to permit preparation of a quantitative comparision matrix. Depending upon the designer's constraints, either the polycrystalline graphites (POCO-AXF-5Q, ATJS) or the more complex composite materials (AVCO 3D C/C, Pyrocarb-406) may be chosen. ERA

N77-21673# California Univ., Los Angeles. School of Engineering and Applied Science.
TRANSPARENT GLASS HONEYCOMB STRUCTURES FOR ENERGY LOSS CONTROL Final Report
H. Buchberg, D. K. Edwards, and J. D. Mackenzie Mar. 1976 97 p refs
(Contract AT(04-3)-1084)
(SAN/1084-75/1; UCLA-ENG-7625) Avail: NTIS HC A05/MF A01

Stacked arrays of thin walled glass tubes and corrugated thin glass sheets were fabricated and demonstrated to be feasible honeycomb constructions for solar collector heat loss control. Likely design values of honeycomb length and diameter were identified within a region limited by temperature difference across the honeycomb, by excessive infrared emittance and conduction, and by deficient solar transmittance. Experimental and analytical performance studies showed that, under comparable conditions, glass honeycomb collectors achieve the highest thermal efficiencies when compared with single glazed selective black and single and double glazed nonselective black collectors and are the most effective when the inlet temperature above ambient air temperature is greater than approximately 30 C. ERA

N77-21674# Sandia Labs., Livermore, Calif.
OPTICAL AND THERMAL CHARACTERISTICS OF A SOLAR COLLECTOR WITH A STATIONARY SPHERICAL REFLECTOR AND A TRACKING ABSORBER
A. M. Clausing (Ill. Univ., Urbana) Aug. 1976 14 p refs Presented at 20th Ann. SPIE Tech. Symp., San Diego, Calif., 23-27 Aug. 1976
(Contract E(29-1)-789)
(SAND-76-8663; Conf-760832-12) Avail: NTIS HC A02/MF A01

A fixed segment of a concave spherical mirror can be used to concentrate beam radiation onto a tracking absorber which pivots about the center of curvature of the mirror. A possible economic advantage of this solar collector over concentrating collectors with tracking mirrors is reduced mirror cost. The objective of the investigation is to determine the potential of this system for electrical power production. Special emphasis is given to identifying the penalty associated with the fixed reflector. The results showed appreciable cosine losses even at the best times of the year. The overall system efficiency was found to be strongly dependent on the rim angle, the optical efficiency, the absorber temperature, and the degree of selectivity of the absorber surface. ERA

N77-21675# Texas Univ., Austin. Center for Energy Studies.
PROCEEDINGS OF SECOND GEOPRESSURED GEOTHERMAL ENERGY CONFERENCE. VOLUME 4: SURFACE TECHNOLOGY AND RESOURCE UTILIZATION Final Report
Gary K. Underhill, Ronald A. Carlson, William A. Clendinning, Jozsef Erdos, John Gault, James W. Hall, Robert L. Jones, Herb K. Michael, Paul H. Powell, Carl F. Riemann et al 1976 396 p refs Conf. held at Austin, Tex., 23-25 Feb. 1976
(Contract E(40-1)-4900)
(CONF-760222-P4) Avail: NTIS HC A17/MF A01

The efficiency of geothermal electric generation plants is known to be low while water resources in most geothermal regions are known to be fully committed. Presented is a survey of the water resources of the Texas Gulf Coast. The impact of meaningful amounts of geothermal generation on the water resources is assessed in terms of subregion and county water resources. ERA

N77-21676# Energy Research and Development Administration, Oak Ridge, Tenn. Technical Information Center.
GEOTHERMAL RESOURCES: EXPLORATION AND EXPLOITATION. A BIBLIOGRAPHY
Jul. 1976 400 p
(TID-3354-R1) Avail: NTIS HC A17/MF A01

This comprehensive bibliography contains 5476 citations of foreign and domestic research reports, journal articles, patents, conference proceedings, and books concerned with the exploration and exploitation of geothermal resources. The coverage dates back as far as useful references could be obtained and extends through June 1976. References are arranged in broad subject categories and are made up of complete bibliographic citations. These are followed by a listing of subject descriptors used to describe the subject content of each reference. Four indexes are included: Corporate, Personal Author, Subject, and Report Number. Also included is a list of journals from which articles were selected. ERA

N77-21677# Texas Univ., Austin. Center for Energy Studies.
PROCEEDINGS OF SECOND GEOPRESSURED GEOTHERMAL ENERGY CONFERENCE. VOLUME 2: RESOURCE ASSESSMENT
D. G. Bebout 1976 36 p refs Conf. held at Austin, Tex., 23-25 Feb. 1976
(Contract E(40-1)-4900)
(CONF-760222-P2) Avail: NTIS HC A03/MF A01

Techniques being used in the assessment of geopressured geothermal resources along the Texas Gulf Coast are described and geologic procedures for test- or industrial-site selection are defined. These approaches have been proven in petroleum exploration and are applicable in geothermal exploration here in the Gulf basin and in other sedimentary basins. ERA

N77-21678# Texas Univ., Austin. Center for Energy Studies.
PROCEEDINGS OF SECOND GEOPRESSURED GEOTHERMAL ENERGY CONFERENCE. VOLUME 3: RESERVOIR RESEARCH AND TECHNOLOGY Final Report
A. L. Podio, K. E. Gray, O. F. Isokrari, R. M. Knapp, I. H. Silberberg, and T. W. Thompson 1976 388 p refs Conf. held at Austin, Tex., 23-25 Feb. 1976
(Contract E(40-1)-4900)
(CONF-760222-P3) Avail: NTIS HC A17/MF A01

Separate abstracts were prepared for the 4 included sections plus the 5 included appendices. ERA

N77-21679# Battelle Pacific Northwest Labs., Richland, Wash.
GEOTHERMAL WATER AND GAS: COLLECTED METHODS FOR SAMPLING AND ANALYSIS: COMMENT ISSUE
J. G. Douglas, R. J. Serne, D. W. Shannon, and E. M. Woodruff Aug. 1976 89 p refs
(Contract E(45-1)-1830)
(BNWL-2094) Avail: NTIS HC A05/MF A01

Compilations of analytic options for constituents in water and gases are given. Also, a survey of published methods of laboratory water analysis is included. It is stated that no recommendation of the applicability of the methods to geothermal brines should be assumed since the intent of the table is to encourage and solicit comments and discussion leading to recommended analytical procedures for geothermal waters and research. ERA

N77-21680# Oak Ridge National Lab., Tenn. Chemistry Div.
PRECIPITATION AND SCALING IN DYNAMIC GEOTHERMAL SYSTEMS
E. G. Bohlmann, A. J. Shor, and P. Berlinski Oct. 1976 50 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5649) Avail: NTIS HC A03/MF A01

A dynamic loop facility for studying scaling in simulated geothermal brines, under conditions such as will be encountered in engineering scale heat transfer equipment, is being constructed. The first phase of the program consists of two principal efforts: modification of an existing 100 gpm titanium loop to provide the engineering scaling test facility, and operation of an approximately 1 gph once-through (experimental) system to provide design data for titanium loop modifications to provide experience with scale formation and characterization. This

experience is being used in planning the scaling studies to be conducted in the dynamic loop facility. ERA

N77-21681# California Univ., Livermore. Lawrence Livermore Lab.
WIND POWER STUDIES: FIELD MEASUREMENT PRIORITIES FOR NUMERICAL ANALYSIS OF WIND ENERGY Progress Report, Apr. - Jun. 1976
Donald M. Hardy 15 Jun. 1976 8 p refs
(Contract W-7405-eng-48)
(UCRL-50034-76-3) Avail: NTIS HC A02/MF A01

Results of initial numerical studies and their role in planning the July-August 1976 field program are presented. The acquisition, calibration, and deployment of meteorological instruments for the field program are reviewed. ERA

N77-21682# Oak Ridge National Lab., Tenn.
THERMODYNAMIC PROPERTIES OF CHROMATE SALTS IN THE THERMOCHEMICAL PRODUCTION OF HYDROGEN FROM WATER
K. Kodama, G. M. Burch, A. P. Cohen, and H. A. Klemm 23 Apr. 1976 40 p refs
(Contract W-7405-eng-26)
(ORNL-MIT-212) Avail: NTIS HC A03/MF A01

The reaction of potassium chromate (VI) with potassium hydroxide produces hydrogen and oxygen in a thermochemical water decomposition cycle. A reaction was selected and investigated to determine the activity of potassium chromate (V), the equilibrium constant, and to assess the cycle with these data. The results of experiments to determine the reaction equilibrium constant indicate the existence of the reaction is questionable. Side reactions which may possibly explain the phenomena observed include oxidation of the nickel reactor, water absorption of potassium hydroxide, and hydrolysis of potassium oxide. A number of recommendations resulting from experimental observations are presented. ERA

N77-21683# Mitre Corp., McLean, Va.
GEOTHERMAL ENERGY RESOURCE UTILIZATION PROGRAM PLANNING
F. T. Grover Mar. 1976 44 p
(Contract E(11-1)-2693)
(MTR-7137; COO-2693-76-1) Avail: NTIS HC A03/MF A01

ERDA's basic strategy for creating alternative energy supplies is to conduct a program of research, development, and demonstration of energy technology which induces and aids private exploitation of geothermal energy resources (commercialization). So that the existence of (user) choice is demonstrated, and as a means of channelizing efforts for the mitigation of the nation's gathering crisis in energy supply, specific commercialization goals were set by ERDA. A procedure is described for planning the achievement of the commercialization goals established for geothermal energy resources. It was prepared for the consideration of the Office of Resources Utilization, of ERDA's Division of Geothermal Energy. ERA

N77-21684# Oak Ridge National Lab., Tenn.
MIUS SYSTEMS ANALYSIS: INITIAL COMPARISONS OF MODULAR-SIZED INTEGRATED UTILITY SYSTEMS AND CONVENTIONAL SYSTEMS
G. Samuels, R. C. Robertson, W. J. Boegly, Jr., L. Breitstein, R. E. Gant, W. L. Griffin, J. T. Meador, A. J. Miller, H. R. Payne, and C. L. Segaser Jun. 1976 266 p refs Sponsored in part by HUD
(Contract W-7405-eng-26)
(ORNL-HUD-MIUS-6) Avail: NTIS HC A12/MF A01

Several methods of supplying electricity, space heating, domestic hot water, and air conditioning services at sites were analyzed. A total of eleven models are considered. Nine of the models studied are garden apartment complexes; eight have 720 dwelling units, and one has 1080 units. All units have a floor area of 900 square feet units in a high-rise apartment building containing 130 dwellings. Gas engines were selected as the prime mover for the total energy systems in the study. The utility grid in the conventional system models is assumed to consist of an equal number of coal-fired and nuclear large base-loaded plants. Emissions of NO/sub x/, SO2, and particulates from the central power station were based on recent federal standards for coal- and oil-fired steam generators. ERA

N77-21685# Rockwell International Corp., Downey, Calif. Space Div.
ECONOMIC AND TECHNICAL FEASIBILITY STUDY FOR ENERGY STORAGE FLYWHEELS Final Report
Dec. 1975 421 p refs
(Contract E(04-3)-1066)
(ERDA-76-65; SD-75-SA-0166) Avail: NTIS HC A18/MF A01

Flywheel energy storage systems (FESS) for energy conservation in the residential, commercial, industrial, transportation, and utility sectors were studied. Emphasis was placed on utility system applications. Results of the study show that FESS are technically feasible for all sectors examined. It was established that the cost of energy storage is the more important factor in the feasibility of FESS applications. ERA

N77-21686# Sandia Labs., Albuquerque, N.Mex. Advanced Energy Projects Div.
SANDIA VERTICAL-AXIS WIND TURBINE PROGRAM Technical Quarterly Report, Jan. - Mar. 1976
Lawrence I. Weingarten, ed. and Ben F. Blackwell, ed. Aug. 1976 55 p refs
(Contract E(29-1)-789)
(SAND-76-0338) Avail: NTIS HC A04/MF A01

Status of general design efforts in the areas of aerodynamics, structures, systems analysis, and testing is reviewed. Preliminary design details of the proposed 17-m turbine/60-kW generator system for power grid application are given along with structural analysis and operational test results for the existing 5-m turbine. ERA

N77-21687# Brookhaven National Lab., Upton, N.Y. Dept. of Applied Science.
ENERGY MODEL DATA BASE PROGRAM
Murrey D. Goldberg, Walter A. Sevian, Ann W. Reisman, and Paula Newhouse Jun. 1976 20 p
(Contract E(30-1)-16)
(BNL-21545) Avail: NTIS HC A02/MF A01

Models developed by the National Center for Analysis of Energy Systems (NCAES) at Brookhaven were developed principally to provide a descriptive or normative overview of the technological aspects of the national energy system in order to permit analysis and intercomparison of the impact of future technological options. To meet the needs of the NCAES for high-quality numeric data, a flexible, open-ended and model-independent computerized data system was developed and named the Energy Model Data Base (EMDB). It was designed to accept files of numeric quantities useful in energy systems modeling, together with the documentation which indicates the source and quality of the numbers. As noted, the EMDB is independent of any particular model, but choices made in both content and format reflect the requirements of the NCAES modeling programs. A non-technical description of the content of the EMDB is given, and its linkage to Brookhaven optimization and network flow models is indicated. ERA

N77-21688# Sandia Labs., Albuquerque, N.Mex.
VERTICAL-AXIS WIND TURBINE TECHNOLOGY WORKSHOP
Jul. 1976 523 p refs Proc. held at Albuquerque, New Mex., 18-20 May 1976
(Contract AT(29-1)-789)
(SAND-76-5586; Conf-7605511) Avail: NTIS HC A22/MF A01

Separate abstracts are included for twenty-nine of the thirty papers presented concerning vertical axis wind turbines. One paper has previously been abstracted and included in the ERDA Energy Data Base and Energy Research Abstracts journal. ERA

N77-21689# Houston Univ., Tex. Dept. of Chemical Engineering.
TWO-PHASE FLOW IN GEOTHERMAL ENERGY SOURCES Progress Report, 1 Oct. 1975 - 30 May 1976
A. E. Dukler Jun. 1976 45 p refs Prepared for Denver Res. Inst.

(Contract E(11-1)-2729)
(TID-27129; PR-1) Avail: NTIS HC A03/MF A01

A geothermal well, comprised of single and two phase sections, was modeled based on two phase flow principles and selected available correlations. A computer algorithm was written in a versatile form that incorporates any desired void fraction correlation and frictional pressure drop correlation as subroutines. The algorithm was used to assess the effects of important parameters on the overall pressure profile in the well in order to identify the pertinent problems that require further experimental and theoretical investigation. In addition, it was used to evaluate the applicability of pertinent two phase flow correlations to geothermal wells. The results of the parametric study indicated the importance of heat losses, mass flow rate, and void fraction effects on pressure profile and well performance. Components of field data that must be obtained from a test well in order to firm up a reliable design and performance code were identified. The theoretical background of critical two phase flow and minimum vapor velocity required for continuous removal of the liquid from the well was made in order to formulate methods of attack. ERA

N77-21690# Maryland Univ., College Park. Dept. of Mechanical Engineering.
OPTIMIZATION STUDIES OF SOLAR ABSORPTION AIR CONDITIONING SYSTEMS Final Progress Report
Redfield W. Allen and Frederick H. Morse Jan. 1976 102 p refs
(Grant NSF GI-39117)
(NSF/RANN/SE/GI-39117/PR/76/2) Avail: NTIS HC A06/MF A01

The objectives of this study were: (1) to perform a detailed thermodynamic cycle analysis of the basic and various modified absorption air conditioning systems under steady state and transient conditions, for a variety of absorbent-refrigerant combinations; (2) to study the effects of deviations of actual process from ideal processes due to temperature differences and pressure drops in various components and irreversibilities due to mixing and separation of the absorbent-refrigerant pair; (3) to exchange information with absorption air conditioning industry engineers; (4) to consider both fixed and tracking collectors, and to use the results of a detailed collector model and develop a simplified model of reasonable accuracy for use in the combined system simulation; and (5) to study and optimize the performance of the combined collector-absorption system on a thermodynamic basis. ERA

N77-21691# Teledyne Energy Systems, Timonium, Md.
SNAP 19 VIKING LANDER SYSTEM PROGRAM Final Report, 1 Jul. 1970 - 30 Jun. 1976
30 Jun. 1976 262 p
(TES-3069-54) Avail: NTIS HC A12/MF A01

A detailed description of the SNAP 19 battery for the Viking Lander is given. ERA

N77-21692# Thermo Electron Corp., Waltham, Mass.
TECHNICAL AND ECONOMIC FEASIBILITY OF SOLAR AUGMENTED PROCESS STEAM GENERATION Final Report
1976 195 p refs
(Contract E(11-1)-2732)
(COO-2732-1) Avail: NTIS HC A09/MF A01

The technical and economic feasibility of solar augmented process steam generation were studied. This approach is analogous to a heat pump that extracts heat from a low temperature reservoir (provided by solar energy) and raises its temperature to a useful level via mechanical work. The shaft power required in the compressor is only one third to one quarter of total steam enthalpy for low pressure process steam (100 psig). This approach permits the use of low cost flat plate collectors. It was concluded that these systems have the potential of yielding payback periods of 5 to 8 years and 10 to 15 years for collector costs of $2/sq ft and $5/sq ft, respectively, depending upon the location. ERA

N77-21693# Coury and Associates, Inc., Denver, Colo.
PRODUCTION OF GEOTHERMAL FLUIDS BY THE NATURAL FLASHING PROCESS: DESIGN AND ANALYSIS OF GEOTHERMAL WELLS IN TWO-PHASE FLOW Annual Report
18 Jun. 1976 46 p refs
(Contract E(11-1)-2729)
(TID-27128; AR-1) Avail: NTIS HC A03/MF A01

An attempt is made to develop a calculational procedure for both the analysis and the design of geothermal wells that are producing a two-phase mixture of steam and brine. Because of limitations in the available data base, part of the program calls for actual field measurement of two-phase flow parameters in producing geothermal wells. Author (ERA)

N77-21694# Brookhaven National Lab., Upton, N.Y. Policy Analysis Div.
ENERGY TECHNOLOGY ASSESSMENT: CONSIDERATIONS OF GEOGRAPHICAL SCALE
P. F. Palmedo 15 May 1976 21 p refs Presented at the Conf. on Technology Assessment of Energy Alternatives, Troy, New York, 17-19 May 1976; sponsored by the Intern. Soc. for Technol. Assessment and Rensselaer Polytech. Inst.
(Contract E(30-1)-16)
(BNL-21663; Conf-760573-1) Avail: NTIS HC A02/MF A01

The geographic scale of decisions is determined almost completely by political juridictions. Some of the implications of the differences between those scales are discussed and an important role for energy technology assessment in mediating between them is suggested. The geographical morphology of energy technology assessment, particularly as that assessment applies to public policy dealt with are those that can have a significant effect on the set of technologies used by a country in the future. Some examples are the determination of a national research and development policy, the setting of air pollutant emission standards for power plants, or the adoption of major energy pricing policies. ERA

N77-21695# California Univ., Livermore. Lawrence Livermore Lab.
FIBER COMPOSITE FLYWHEEL PROGRAM Quarterly Progress Report, Apr. - Jun. 1976
R. G. Stone Aug. 1976 22 p refs
(Contract W-7405-eng-48)
(UCRL-50033-76-2) Avail: NTIS HC A02/MF A01

Research progress for the reporting period is given on flywheel design, fiber studies and flywheel testing, flywheel process development, composite properties, epoxy resins, and stress rupture. ERA

N77-21696# Oak Ridge National Lab., Tenn.
ENERGY DEMAND AND INTERFUEL SUBSTITUTION IN THE COMBINED RESIDENTIAL AND COMMERCIAL SECTOR
Wen S. Chern Sep. 1976 37 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5557) Avail: NTIS HC A03/MF A01

An integrated energy-demand model for the combined residential and commercial sector is presented. The model consists of two parts: the first determines aggregate demand for energy, and the second estimates market-shares for electricity, natural gas, and petroleum products. Demand elasticities for aggregate as well as individual fuels are analytically derivable. The study concludes that pricing strategies are effective in stimulating the conservation of energy. Results show that raising the prices of electricity is far more effective for energy conservation than raising the prices of natural gas and petroleum products. ERA

N77-21697# Pennsylvania State Univ., University Park.
EXPERIMENTAL RESULTS FOR A HEAT PUMP SYSTEM WITH THERMAL STORAGE
M. W. Wildin, S. F. Gilman, E. R. McLaughlin, and F. H. Bridgers 1976 28 p refs Presented at Conf. on Improving Efficiency and Performance of HVAC Equipment and Systems for Com. and Ind. Buildings, Lafayette, Ind., 12 Apr. 1976
(Contract E(11-1)-2704)
(COO-2704-3; Conf-760488) Avail: NTIS HC A03/MF A01

Data were obtained for a brief winter period from a heat pump system with thermal storage. The heat pump system is comprised of a seven and one-half ton water chiller with reciprocating compressor and five water-to-air heat pumps having a total cooling capacity of six and one-half tons. The heat rejected

by the heat pumps during cooling mode operation is stored in 6000 gallons of water and withdrawn during heating mode operation. The energy recovered and stored during daytime operation was more than adequate to satisfy nighttime heating needs during the period of observation. ERA

N77-21698# Pennsylvania Univ., Philadelphia.
PLANNING FOR A PROGRAM DESIGN FOR ENERGY ENVIRONMENTAL ANALYSIS Final Draft Report
J. Denton, T. Saaty, P. Blair, F. Ma, and P. Buneman 1976 302 p refs
(Contract E(11-1)-2547)
(COO-2547-6) Avail: NTIS HC A14/MF A01

The focus of the work was to examine the use of operational gaming for regional assessment studies. Specific concerns were gaming applications (1) in regional assessment or management and direction of regional assessments; (2) for achieving a higher level of public understanding of environmental, health, and safety problems of energy; (3) with respect to the supply of adequately trained manpower for energy; (4) with respect to computational requirements; and (5) with respect to current state-of-the-art in computer simulation. In order to investigate these concerns and examine the feasibility of using operational gaming in a regional assessment study program, a Regional Energy Environment Game (REEG) was designed and implemented on an IBM 370/168 digital computer employing APL. ERA

N77-21699# Sandia Labs., Albuquerque, N.Mex.
RANKINE CYCLE ENERGY CONVERSION SYSTEM DESIGN CONSIDERATIONS FOR LOW AND INTERMEDIATE TEMPERATURE SENSIBLE HEAT SOURCES
J. P. Abbin, Jr. Oct. 1976 18 p ref
(Contract E(29-1)-789)
(SAND-76-0363) Avail: NTIS HC A02/MF A01

Design considerations are described for energy conversion systems for low and intermediate temperature sensible heat sources such as found in geothermal, waste heat, and solar-thermal applications. The most cost effective designs for the applications studied did not require the most efficient thermodynamic cycle, but that the efficiency of the energy conversion hardware can be a key factor. ERA

N77-21700# Central Organisation TNO, Delft (Netherlands).
THE POTENTIAL HEAT PRODUCTION OF VARIOUS TYPES OF COLLECTORS UNDER THE CLIMATOLOGICAL CIRCUMSTANCES OF THE NETHERLANDS [DE POTENTIELE WARMTEPRODUKTIE VAN DIVERSE TYPEN COLLECTOREN IN NEDERLANDSE KLIMATOLOGISCHE OMSTANDIGHEDEN]
C. DenOuden [1976] 28 p refs In DUTCH
Avail: NTIS HC A03/MF A01

The possibility of producing heat with solar energy collectors in the Netherlands is discussed. Efficiency formulas for flat plat collectors are given and efficiency in practice and possibilities of improving efficiency are discussed. The yearly solar energy production is compared with various collector types and the influence of the collector heat capacity on energy capture is discussed. The thermal behavior of a solar house is dealt with. ESA

N77-21701# European Space Agency, Paris (France).
PRODUCTION OF CHEMICAL ENERGY CARRIERS BY NON-EXPANDABLE ENERGY SOURCES
Joachim Nitsch Feb. 1977 74 p refs Transl. into ENGLISH of 'Die Erzeugung chem. Energietraeger mittels regenerativer Energiequellen', DFVLR, Hardthausen, West Ger. Report DLR-FB-76-32, 8 Jun. 1976 Original report in GERMAN previously announced as ESA-98163 Original German report available from DFVLR, Cologne DM 22.40
(ESA-TT-338; DLR-FB-76-32) Avail: NTIS HC A04/MF A01

The different forms of energy (radiation, high-temperature heat, and electricity) arising from non-expendable energy sources like solar energy can be used for the production of chemical energy-carriers. Possible methods are the splitting of water by means of photolysis, thermochemical cycles and electrolysis, and the storage of energy in closed loop chemical systems. These methods are described, and efficiencies and costs of the production of these energy carriers are specified. Special problems of the long-distance transportation of hydrogen produced by solar energy are described, and the resulting costs estimated. Author (ESA)

N77-21702# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
PHOTOVOLTAIC II-VI COMPOUND HETEROJUNCTIONS FOR SOLAR ENERGY CONVERSION Ph.D. Thesis
Fredrik Buch Jun. 1976 133 p refs
(Grant NSF AER-75-1679)
(PB-259195/6; NSF/RANN/SE/AER75-1679/76; NSF/RA-760209) Avail: NTIS HC A07/MF A01 CSCL 10B

Several cells of each type were made and tested, and it was found that the current transport mechanism is thermal activation and tunneling into the heterointerface, where recombination takes place. To describe the current-voltage behavior in light, a collection function that represents the bias voltage dependence of the collection of photogenerated carriers, was introduced. From the collection function, the cell diffusion potentials have been determined, and using the film and substrate carrier densities, the election affinities for CdSe (4.58 eV) and ZnTe (3.74 eV) were calculated relative to the electron affinity of CdTe. GRA

N77-21703# Wayne State Univ., Detroit, Mich. Dept. of Chemistry.
CUPROUS OXIDE PHOTOVOLTAIC CELLS Quarterly Report, 1 Apr. - 30 Jun. 1976
Dan Trivich Aug. 1976 19 p
(Grant NSF AER-75-23453)
(PB-259255/8; NSF/RA-760199; QR-3) Avail: NTIS HC A02/MF A01 CSCL 10B

The effect of heat treatment of the samples in a vacuum preceding metallization is studied for the case of aluminum top contacts. The optimum temperature appears to be 150 C. However, this represents the stage temperature which may not be the same as the sample temperature. While the desirability of heat treatment is established, the actual optimum temperatures at the sample are not yet established. The progress to date will be consolidated by working out uniform procedures to prepared cells with more closely reproducible characteristics especially with copper contacts on Cu2O. GRA

N77-21704# Transportation Systems Center, Cambridge, Mass.
THE ADVISABILITY OF REGULATING ELECTRIC VEHICLES FOR ENERGY CONSERVATION Report, Feb. - Aug. 1976
S. F. Powel, III and M. Rosenberg Aug. 1976 231 p refs
(PB-260667/1; DOT-TSC-OST-76-37) Avail: NTIS HC A11/MF A01 CSCL 13F

Vehicles that do not consume fuel are examined to determine if they should be included under the provisions of the Motor Vehicle Information and Cost Savings Act, as amended by Title III of the Energy Policy and Conservation Act. GRA

N77-21705# Rice Inst., Houston, Tex. Dept. of Mathematical Sciences.
STRATEGIC STUDIES FOR ENERGY PLANNING AND MANAGEMENT Final Report
Jun. 1976 88 p
(Grant NSF SIA-75-04329)
(PB-260364/5; NSF/RA-760272) Avail: NTIS HC A05/MF A01 CSCL 10A

Game theory, the mathematical modeling of conflict between various players, has great potential in analyzing the many different strategies and outcomes of the energy situation. This theory forms the basis for the four reports included in this document: (1) Roles for Game Theory in Energy Planning and Management, (2) A game Theoretic Analysis of Alternate Source Development, (3) Maximizations of Total Profits Attending Exploitation of Finite Resources, and (4) A Note on Intertemporal Game Models of Energy, Exchange, and Economic Growth. GRA

N77-21706# Stanford Research Inst., Menlo Park, Calif.
A WESTERN REGIONAL ENERGY DEVELOPMENT STUDY: ECONOMICS. VOLUME 1: SRI ENERGY MODEL RESULTS Final Report
Nov. 1976 277 p Sponsored in part by EPA, ERDA and Dept. of Interior
(Contract EQ5AC007; EQ5AC008; SRI Proj. 4000)

(PB-260835/4) Avail: NTIS HC A13/MF A01 CSCL 21D

The economics of 38 energy resource development scenarios are examined. The supply analysis looks at capital investments and operating costs for extracting, converting, and transporting all forms of energy. The data were placed in a computer model along with a projection of U.S. energy demands to the year 2000. Vol. 1 presents the results and the Executive Summary. GRA

N77-21707# Stanford Research Inst., Menlo Park, Calif.
A WESTERN REGIONAL ENERGY DEVELOPMENT STUDY: ECONOMICS. VOLUME 2: SRI ENERGY MODEL DATA BASE Final Report
Nov. 1976 231 p Sponsored in part by EPA, ERDA and Dept. of Interior
(Contracts EQ5AC007; EQ5AC008; SRI Proj. 4000)
(PB-260836/2) Avail: NTIS HC A11/MF A01 CSCL 21D

The economics of 38 energy resource development scenarios are examined. The supply analysis looks at capital investments and operating costs for extracting, converting, and transporting all forms of energy. The data were placed in a computer model along with a projection of U.S. energy demands to the year 2000. GRA

N77-21708# Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.
PETROLOGY OF THE QUATERNARY VOLCANICS OF THE ROOSEVELT KGRA, AND ADJOINING AREA, UTAH, VOLUME 1 Final Report
W. P. Nash Jun. 1972 103 p refs
(Grant NSF GI-43741)
(PB-261549/0; NSF/RA-760368-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 08I

The volcanics are high-silica rhyolites and occur as domes, flows and tuffs. Initial eruptions resulted in two flows of low viscosity, phenocryst-poor rhyolite. Later activity consisted of pyroclastic eruptions and the emplacement of at least 9 viscous domes. In addition to abundant glass, the rhyolites contain alkali feldspar, plagioclase, biotite, iron-titanium oxides and small amounts of hornblende, allanite, apatite, zircon, sphene and topaz. Magmatic temperatures were about 700 C, and water fugacities ranged from 350 to 3,450 bars. Based on water fugacity calculations it is concluded that there may have been one or more shallow magma chambers in the Mineral Range at depths of about 1.6 km. GRA

N77-21709# Stanford Univ., Calif.
WORKSHOP ON GEOTHERMAL RESERVOIR ENGINEERING
Paul Kruger and Henry J. Ramey, Jr. 1976 278 p refs Workshop held at Stanford, Calif., 15-18 Dec. 1975
(Grant NSF AER-72-03490)
(PB-261319/8; NSF/RA-760172; SGR-TR-12) Avail: NTIS HC A13/MF A01 CSCL 08I

The major areas covered in the program consist of reservoir physics (studies to evaluate the physical processes occurring in geothermal systems), well testing (techniques used in specific and generic fields to determine the columeric and extractive characteristics of a reservoir), field development of producing fields, well stimulation (techniques for improving energy recovery from marginal hydrothermal and dry geothermal resources), and modelling (mathematical methods to study geothermal reservoirs). Summaries of 50 technical papers from the five sessions are included in these proceedings. GRA

N77-21710# National Bureau of Standards, Washington, D. C. Center for Building Technology.
UNITARY HEAT PUMP SPECIFICATION FOR MILITARY FAMILY HOUSING Final Report
C. W. Phillips, B. A. Peavy, and W. J. Mulroy Mar. 1976 30 p Sponsored by AF
(PB-261199/4; NBSIR-76-1029) Avail: NTIS HC A03/MF A01 CSCL 13A

Unitary heat pump equipment requirements for performance, testing, rating, design, safety, serviceability and reliability for system and components; and conformance conditions were established. Guidance in military procurement is provided, and it applies to hermetic electrically-driven vapor-compression unitary heat pumps of the remote (split) and packaged (integral) types, the air to air and water to air classes, and sizes from 17,000 to 84,000 Btu/hr for both heating and cooling functions. GRA

N77-21711# Lear Motors Corp., Reno, Nev.
GEOTHERMAL HOT WATER PUMP Technical Report, Sep. 1974 - Apr. 1976
Apr. 1976 114 p
(Grant NSF AER-74-18753)
(PB-261741/3; LMC-760504-A; NSF/RA-760379) Avail: NTIS HC A06/MF A01 CSCL 08I

A high-speed electric motor driven submersible pump which can operate at depths of 1,000 feet or more, and at temperatures up to 450 F, was developed. Presented are the motor and pump design, and the results of all testing performed to date on the engineering prototype system. GRA

N77-21712# HOLT/PROCON, Pasadena, Calif.
ENERGY CONVERSION AND ECONOMICS FOR GEOTHERMAL POWER GENERATION AT HEBER, CALIFORNIA, VALLES CALDERA, NEW MEXICO, AND RALT RIVER, IDAHO: CASE STUDIES Topical Report no. 2
Ben Holt and Edward L. Ghormley Nov. 1976 124 p Sponsored by Electric Power Research Inst.
(PB-261845/2; EPRI-ER-301) Avail: NTIS HC A06/MF A01 CSCL 10B

The compatibility of various power conversion options with real geothermal reservoirs was investigated and the economics of power generation was analyzed. Conversion technologies considered for the near term were flashed steam, binary, and hybrid (flashed steam/binary). GRA

N77-21713# Battelle Columbus Labs., Ohio.
ENERGY USE PATTERNS IN METALLURGICAL AND NONMETALLIC MINERAL PROCESSING (PHASE 7: SUMMARY OF THE RESULTS OF PHASES 4, 5, AND 6) Final Report
21 Sep. 1976 30 p
(Contract DI-BM-S0144093)
(PB-261151/5; BuMines-OFR-117-76-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 10A

The energy content of 83 metallic and nonmetallic nonfuel commodities derived from mineral deposites are summarized. The energy content per ton of product and total energy equivalent for U.S. 1973 consumption are tabulated for each commodity. High intermediate and low priority commodities are tabulated according to energy content for each stage from mining to final processing. The requirements for each priority grouping are also compared by source of energy. GRA

N77-21714# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
WIND ENERGY STATISTICS FOR LARGE ARRAYS OF WIND TURBINES (NEW ENGLAND AND CENTRAL US REGIONS) Final Report
C. G. Justus Aug. 1976 129 p refs
(Grant NSF AER-75-00547)
(PB-260679/6; NSF/RA-760191; ERDA/NSF-00547/76/1) Avail: NTIS HC A07/MF A01 CSCL 10B

The performance characteristics were simulated for large dispersed arrays of 500 kW-1500 wind turbines producing power and feeding it directly into the utility distribution grid in the New England - Middle Atlantic and the Central U.S. regions. Despite comparable wind regimes in coastal New England and in the Central U.S., wind power is potentially more cost effective as a fuel saver in New England. This is because of the heavy reliance on expensive fuels in New England as compared with the Central U.S. area. By array power return time analysis, it was estimated that 24 to 48 hours of storage would increase the power reliability of 200 kW per 1500 kW generator to about 95 percent in New England, and to better than 95 percent in the Central U.S. Preliminary analysis of diurnal cycles of monthly mean winds versus time of day shows that in both New England and the Central U.S.,, there is a strong summertime afternoon peak in availavle wind, which would correspond to the summertime peak air conditioning load. GRA

N77-21715# Battelle Pacific Northwest Labs., Richland, Wash.
AN INPUT/OUTPUT ANALYSIS OF ENERGY USE CHANGE FROM 1947 TO 1958, 1958 TO 1963 AND 1963 TO 1967 Final Report
M. Searl and William A. Reardon Nov. 1976 90 p refs
(PB-260596/2; EPRI-EA-281) Avail: NTIS HC A05/MF A01 CSCL 10A

The energy used to produce a real dollar of output in 1947, 1958, 1963, and 1967 for thirty energy consuming sectors is computed. The energy used by four energy producing sectors to produce a given amount of energy output is also calculated. Similar computations are made per unit of final demand. Diverse trends exist among the sectors considered. Some sectors, such as rubber and miscellaneous plastics show a continuing decrease in the amount of energy required per unit of output or final demand. A number of sectors, such as agriculture showed decreasing energy intensity through 1963 and greater energy intensity in 1967. GRA

N77-21716# National Academy of Sciences - National Research Council, Washington, D. C.
ENERGY FOR RURAL DEVELOPMENT: RENEWABLE RESOURCES AND ALTERNATIVE TECHNOLOGIES FOR DEVELOPING COUNTRIES
1976 306 p refs
(PB-260606/9) Avail: NTIS HC A14/MF A01 CSCL 10A

A summary of the state of the art of alternative technologies frequently suggested as solutions to rural or individual-family energy needs is provided. It informs both the technologist and the planner where to go for more detailed information and what kinds of research and development are needed before a particular device or process is ready for use. GRA

N77-21717# Charles River Associates, Inc., Cambridge, Mass.
LONG-RANGE FORECASTING PROPERTIES OF STATE-OF-THE-ART MODELS OF DEMAND FOR ELECTRIC ENERGY, VOLUME 1 Final Report
William H. Hieronymus Dec. 1976 456 p refs Sponsored by Electric Power Res. Inst. 2 Vol.
(PB-261767/8; EPRI-EA-221-Vol-1) Avail: NTIS HC A20/MF A01 CSCL 10A

The long-range forecasting effectiveness of selected econometric models of the demand for electric energy is reported. The eight models tested represent those specifications and other features of extant models believed to be of potential use in developing improved models for long-range forecasting at the national and regional levels. Each model is replicated, reestimated on a common data set and tested for performance: forecast and backcast accuracy, parameter stability over time, robustness of parameter estimates to small changes in specification or variable measurement, consistency and plausibility of model results, and quality of model test statistics. GRA

N77-21718# Charles River Associates, Inc., Cambridge, Mass.
LONG-RANGE FORECASTING PROPERTIES OF STATE-OF-THE-ART MODELS OF DEMAND FOR ELECTRIC ENERGY. VOLUME 2: ANNOTATED BIBLIOGRAPHY Final Report
William H. Hieronymus Dec. 1976 47 p refs Sponsored by Electric Power Res. Inst. 2 Vol.
(PB-261766/0; EPRI-EA-221-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 10A

An annotated bibliography of long-term electric energy forecasting models is presented. GRA

N77-21719# RAND Corp., Santa Monica, Calif.
ENERGY CONSERVATION IN NONRESIDENTIAL BUILDINGS
Richard G. Salter, Robert L. Petruschell, and Kathleen A. Wolf Oct. 1976 214 p refs
(Grants NSF SIA-74-18660; NSF GI-44)
(PB-260732/3; R-1623-NSF; NSF/RA-760301) Avail: NTIS HC A10/MF A01 CSCL 13A

A quantitative data base is developed using a computer model to calculate monthly and annual energy requirements by accumulating successive hourly energy balances. Results are obtained for a number of building configurations across a spectrum of locations in the United States. These calculations enable examination of the effects of various building design variables on annual heating and cooling requirements, and various building energy systems on purchased energy requirements. A number of generic building energy systems are compared on an energy use, first cost, and life-cycle cost basis. GRA

N77-21720# National Association of Counties, Washington, D.C.
A GUIDE TO REDUCING ENERGY USE BUDGET COSTS
Nov. 1976 95 p refs Prepared in cooperation with National League of Cities
(Contracts FEA-CO-12-60505-00; FEA-CO-12-60509-00)
(PB-260632/5; FEA/E-76/451) Avail: NTIS HC A05/MF A01 CSCL 10A

City and county governments are provided with straightforward, practical information needed to reduce energy costs and save taxpayers money. Local government officials will find the basic 'whys,' 'how-to's,' and 'by whoms' of successful energy management carefully spelled out, so that specific programs can be selected and tailored to a specific community. GRA

N77-21721# Atlas Corp., Santa Clara, Calif.
PROCEEDINGS OF FIRST SEMIANNUAL EPRI SOLAR PROGRAM REVIEW MEETING AND WORKSHOP. VOLUME 1: SOLAR HEATING AND COOLING OF BUILDINGS
P. Bos 12 Mar. 1976 124 p refs Proc. held at San Diego, Calif., 8-12 Mar. 1976 Sponsored by EPRI
(PB-260594/7; EPRI-ER-283-SR-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 13A

A brief description of the ERDA solar program covering current and projected activities in the thermal applications and electric applications, solar heating and cooling of buildings requirements, definition and impact analysis, individual load center-solar heating and cooling residential project, an investigation of methods to improve heat pump performance and reliability in a northern climate, solar materials and components test program, and solar data verification project are discussed. GRA

N77-21722# Atlas Corp., Santa Clara, Calif.
PROCEEDINGS OF FIRST SEMIANNUAL EPRI SOLAR PROGRAM REVIEW MEETING AND WORKSHOP. VOLUME 2: SOLAR ELECTRIC POWER
P. Bos 12 Mar. 1976 239 p refs Proc. held at San Diego, Calif., 8-12 Mar. 1976 Sponsored by EPRI
(PB-260595/4; EPRI-ER-283-SR-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 10B

Environmental assessment of solar energy power plants, requirements definition and impact analysis of solar thermal power plants, closed cycle high temperature central receiver concept for solar electric power, open cycle gas turbine solar electric system, preliminary system analysis of a solar power central station, requirements for utility systems of large-scale utilization of solar power plants, requirements assessment of photovoltaic electric power systems and thermophotovoltaic project are discussed. GRA

N77-21723# Oklahoma Univ., Norman. Bureau of Water Resources Research.
AN EXPLORATORY STUDY OF POSSIBLE ENERGY SAVINGS AS A RESULT OF WATER CONSERVATION PRACTICES
George W. Reid Jul. 1976 144 p refs Sponsored by Dept. of Interior
(PB-260490/8; W77-01052; OWRT-A-061-OKLA(1)) Avail: NTIS HC A07/MF A01 CSCL 10A

Energy consumption from the use of various alternatives of water conservation practices is evaluated. Comparisons of eighty-one possible household water conservation devices and reuse systems with conventional water use methods and comparisons of flow reduction from residential uses as results of the alternatives are included. Total monetary savings in energy of alternatives associated with pumping, heating, transmission and operating for water production and wastewater treatment are compared with the total monetary savings in water of the water-saving devices. A cost-effectiveness analysis and the ratings of the conservation alternatives in terms of both energy and water saved are included. GRA

N77-21724# Iowa Inst. of Hydraulic Research, Iowa City.
ANALYSIS OF DIFFERENT TYPES OF DRY-WET COOLING TOWERS
Mow-Soung Cheng, Thomas E. Croley, II, and V. C. Patel Jul. 1976 190 p refs
(Contract DI-14-31-0001-5201)
(PB-261315/6; IIHR-191) Avail: NTIS HC A09/MF A01 CSCL 13A

Computer models have been developed to study the thermodynamic and economic performance of various types of combination dry-wet cooling towers. The models consider the basic thermodynamics of wet and dry heat transfer, steam turbines, and condensers, the influence of different power loading patterns and changing meteorological conditions, and the various economic parameters. GRA

N77-21725# Geothermal Resources Council, Davis, Calif.
PROCEEDINGS OF 2ND WORKSHOP ON MATERIALS PROBLEMS ASSOCIATED WITH THE DEVELOPMENT OF GEOTHERMAL ENERGY SYSTEMS
1976 132 p refs Proc. held at El Centro, Calif., 16-18 May 1975
(Contract DI-BM-P0152088)
(PB-261349/5; BM-OFR-128-76) Avail: NTIS HC A07/MF A01 CSCL 11F

The proceedings of the second workshop on materials problems associated with the development of geothermal energy systems are reported. Topics covered include scale formation, corrosion, and fabrication problems. Materials developed for chloride environments are also described. GRA

N77-21726# Hawaii Univ., Honolulu. Dept. of Mechanical Engineering.
NUMERICAL SOLUTIONS FOR TRANSIENT HEATING AND WITHDRAWAL OF FLUID IN A LIQUID-DOMINATED GEOTHERMAL RESERVOIR
Ping Cheng and Lall Teckchandani Aug. 1976 26 p refs
(Contract E(04-3)-1093; Grant NSF GI-38319)
(PB-261562/3; HGP-TR-17; NSF/RA-760376) Avail: NTIS HC A03/MF A01 CSCL 08I

The transient responses in a liquid-dominated geothermal reservoir resulting from the sudden heating and withdrawal of fluids are studied numerically. The two-dimensional rectangular reservoir is confined by caprock at the top, heated by bedrock from below, and recharged continuously from the vertical boundaries. With appropriate approximations, the governing equations are combined and reduced to two non-linear partial differential equations in terms of dimensionless temperature and pressure. The finite difference form of the temperature is solved numerically by the alternating direction implicit method while that of the pressure equation is solved by the Crank-Nicholson method. GRA

N77-21727# Bechtel Corp., San Francisco, Calif. Research and Engineering.
ENGINEERING DESIGN AND COST ANALYSIS OF CHLORINE STORAGE CONCEPTS FOR A ZINC-CHLORINE LOAD-LEVELING BATTERY Final Report
R. F. Battey Nov. 1976 118 p refs Sponsored by Elec. Power Res. Inst.
(EPRI Proj. 731-1)
(PB-262016/9; EPRI-EM-259) Avail: NTIS HC A06/MF A01 CSCL 10C

Alternate chlorine storage approaches were evaluated and compared in terms of the key technical, safety, economic, and environmental aspects. It is demonstrated that for an ambient pressure zinc-chloride battery the chlorine hydrate approach is a simpler and less expensive storage system than liquid chlorine. Absorption of chlorine in carbon tetrachloride was ruled out because adequate energy efficiencies could not be obtained for the battery system using this chlorine-storage concept. An analysis of the chlorine storage systems studied indicates that safety hazards are moderate and that no extraordinary hazards exist. GRA

N77-21728# National Conference of State Legislatures, Denver, Colo.
STATE POLICIES FOR GEOTHERMAL DEVELOPMENT. UNCOVERING A MAJOR RESOURCE Final Report
Douglas M. Sacarto Nov. 1976 105 p refs
(Grant NSF ISR-74-1152)
(PB-261744/7; NSF/RA-760230) Avail: NTIS HC A06/MF A01 CSCL 08I

Research results from numerous specialists are summarized, and present state and Federal policies affecting the geothermal industry are outlined. Key policy areas are identified, and several specific actions suggested for the states. Six appendixes are included: (1) state laws and regulations regarding geothermal resources; (2) Federal geothermal leasing and development regulations; (3) Federal geothermal lease summary; (4) Federal geothermal steam act; (5) Federal geothermal energy research, development, and demonstration act; and (6) regulations for the geothermal loan guaranty program. GRA

N77-21729# Texas Univ., Dallas. Inst. for Geosciences.
TELLURIC MAPPING, TELLURIC PROFILING, AND SELF-POTENTIAL SURVEYS OF THE DUNES GEOTHERMAL ANOMALY, IMPERIAL VALLEY, CALIFORNIA
Jim Combs and Michael Wilt 1975 45 p refs
(Grant NSF AER-72-03551)
(PB-261690/2; Contrib-290; NSF/RA/N-75-332) Avail: NTIS HC A03/MF A01 CSCL 08I

The Dunes Anomaly is probably fault controlled, i.e., polarization and noise analysis suggest that the controlling geological structure is a northwest trending strike-slip fault located in the sand hills. The postulated extension of the San Andreas Fault Zone is a logical possibility. The existence of northeast trending conjugate faulting is not ruled out since it is noted that the gravity high associated with the Dunes Anomaly is actually centered about 2 km northeast of the UCR no. 115 borehole. The Dunes Geothermal Anomaly could be associated with a larger structure centered beneath the gravity maximum. Finally, split spread telluric profiling was found to be a rapid low cost method of geothermal exploration. GRA

N77-21730# Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.
TEST ELECTROMAGNETIC SOUNDINGS, ROOSEVELT HOT SPRINGS KGRA
W. E. Petrick 1976 21 p refs
(Grant NSF GI-43741)
(PB-261751/2; NSF/RA-760367; TR-74-1) Avail: NTIS HC A02/MF A01 CSCL 08I

The Roosevelt area is located on the western flanks of the Mineral Range in Beaver County, Utah, and consists mostly of Precambrian metamorphic rocks and Tertiary igneous rocks. This site was chosen for the Vertical Magnetic Dipole (VMD) Survey. The center of the transmitting dipole was located approximately 275 feet east of the siliceous apron. Three receiving stations were located along a traverse line bearing approximately S 55 W from the transmitter. Conclusions drawn from the survey are as follows: least square inversion of 14 frequency electromagnetic data taken near Roosevelt Hot Springs indicate a three layered earth model grading easterly into a two layered model GRA

N77-21731# Pennsylvania State Univ., University Park. Dept. of Geosciences.
PRELIMINARY STUDY OF THE IMPORTANCE OF HYDROTHERMAL REACTIONS ON THE TEMPERATURE HISTORY OF A HOT, DRY ROCK GEOTHERMAL RESERVOIR M.S. Thesis
James R. Morris Jul. 1975 90 p refs
(Grant NSF AER-74-08473)
(PB-262391/6; NSF/RA/N-75-353) Avail: NTIS HC A05/MF A01 CSCL 08I

A theoretical computer model, based upon the finite element method, of a two-dimensional fracture in a hot, dry rock geothermal reservoir was developed and tested. Hydrothermal reactions occurring between water and a granitic source rock were subdivided into two categories: dissolving reactions and alteration reactions. It was found that the quartz dissolving reaction had little or no direct effect on reservoir temperatures for any combination of flow and fracture parameters. The location of maximum quartz dissolving was obtained as a function of time. Detailed studies of the time dependence of rock and water temperatures with and without alteration were determined. GRA

N77-21732# Sperry Rand Research Center, Sudbury, Mass. Systems Requirements and Applications Lab.
GEOTHERMAL DOWN-WELL PUMPING SYSTEM Final Report
R. H. Fuller 16 Aug. 1976 35 p refs
(Grant NSF AER-74-08874)
(PB-261857/7; SCRC-CR-76-46; NSF/RA-760342) Avail: NTIS HC A03/MF A01 CSCL 08I

The results of the turbo pump laboratory tests including the measured performance of the 900 gpm pump impeller are documented. A small quantity of working fluid (1% to 2% of brine flow) is sent down to the pumping unit through a down-hole heat exchanger, which consists of two annuli formed by the well casing and two concentric lengths of standard oil field tubing. The working fluid flows down the inner annulus, and the hot brine flows up the outside annulus. Thus heat is transferred from the brine across the wall of the boiler tube and into the working fluid. The working fluid vapor is used to drive a turbine, which in turn drives the pump impeller. GRA

N77-21126*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STATUS OF GOLDSTONE SOLAR ENERGY SYSTEM STUDY OF THE FIRST GOLDSTONE ENERGY PROJECT
F. L. Lansing *In its* The Deep Space Network 15 Apr. 1977 p 120-140 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 10A

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N77-21733*# Science Applications, Inc., La Jolla, Calif.
AIRBORNE HCl - CO SENSING SYSTEM Final Report, Oct. 1974 - Mar. 1977
E. R. Bartle and Gordon Hall 30 Mar. 1977 72 p refs
(Contract NAS1-13573)
(NASA-CR-145095; SAI-76-717-LJ) Avail: NTIS HC A04/MF A01 CSCL 14B

A system for measuring air pollutants in-situ using an aircraft was designed, fabricated, and tested. The system is based upon a technique called Gas Filter Correlation (GFC) which provides for high sensitivity and specificity in the presence of interfering species. This particular system was designed for measuring hydrochloric acid and carbon monoxide gases emitted from rocket exhaust effluents. Author

N77-21734# National Aeronautical Establishment, Ottawa (Ontario).
SOME ENVIRONMENTAL MEASUREMENT OF THE VERTICAL SPREAD OF POLLUTANTS FROM LOW-LEVEL SOURCES
R. S. Crabbe Apr. 1975 45 p refs
(LTR-UA-28) Avail: NTIS HC A03/MF A01

As a contribution to pesticide accountancy, a series of environmental experiments on the mean vertical spread of gaseous and aerosol pollutants from ground-based sources has been performed. For the former, reasonable agreement between theoretical analysis and airborne and surface measurements is demonstrated. A dimensional analysis is suggested for using similar data to predict the general case. A method to predict the required number of crosswind passes to obtain the time mean values of laterally integrated concentration in a plume is also presented and verified by experiment. Author

N77-21735*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF OZONE MEASUREMENT TECHNIQUES USING AIRCRAFT, BALLOON, AND GROUND-BASED MEASUREMENTS
Daniel Briehl and Gregory M. Reck Washington Apr. 1977 18 p refs
(NASA-TM-X-3520; E-8951) Avail: NTIS HC A02/MF A01 CSCL 04A

In order to verify the ultraviolet absorption technique used in the Global Atmospheric Sampling Program, two flight experiments were conducted employing several techniques, both in situ and remote, for measuring atmospheric ozone. The first experiment used the NASA CV-990 equipped with an ultraviolet absorption ozone monitor and an ultraviolet spectrophotometer, a balloon ozonesonde, and a Dobson station for determining and comparing the ozone concentration data. A second experiment compared ozone data from an automated sampling system aboard a B-747 with data from a manned system installed on the NASA CV-990 during a cross-country flight with both aircraft following the same flight path separated by 32 kilometers.
Author

N77-21736# Drexel Univ., Philadelphia, Pa.
EFFECTS OF MESOSCALE WEATHER DISTURBANCES ON CONTAMINATION CONCENTRATIONS Technical Progress Report, 1 May 1975 - 31 Jul. 1976
C. W. Kreitzberg 1976 11 p
(Contract E(11-1)-2360)
(COO-2360-3; TPR-3) Avail: NTIS HC A02/MF A01

Development of a regional scale numerical weather prediction model that can be run in real time for prediction of air transport and cleansing by precipitation (stable or convective precipitation) was completed. The model can also be used for simulation studies of regional trajectory dispersion or for design studies for field experiments that observe regional scale air pollution transport. Extensive tests have been completed on the sensitivity of precipitation (hence, cleansing) to the initial moisture field. Tests are being conducted on the sensitivity of trajectories and trajectory dispersion to model grid resolution. An extensive study is nearing completion on the dynamics of the sea breeze and turbulent forcing at the interface of the water and land atmospheric boundary layers. ERA

N77-21737# Oak Ridge National Lab., Tenn.
STATE-OF-THE-ART AND PROPOSED TESTING FOR ENVIRONMENTAL TRANSPORT OF TOXIC SUBSTANCES
J. P. Witherspoon, E. A. Bondietti, S. Draggan, F. P. Taub, N. Pearson, and J. R. Trabalka Aug. 1976 165 p refs
(Contract W-7405-eng-26)
(ORNL/EPA-1) Avail: NTIS HC A08/MF A01

A review and evaluation of the use of soil, laboratory microcosm, and field tests to determine transport of chemicals is presented. The soil thin layer chromatography test appears to be the best method for evaluating mobility of chemicals in soil. Laboratory results with this method were verified in a number of field studies. Review of studies on sediment water interactions indicated that batch equilibrium techniques are used to test mobility of chemicals in sediments. Review of laboratory microcosm studies revealed that microcosms served as useful tools in the study of movement of nutrients, toxic substances, and energy. ERA

N77-21738# Central Lab. TNO, Delft (Netherlands).
PHOTOCHEMICAL AIR POLLUTION. THE ORIGIN OF PHOTOCHEMICAL AIR POLLUTION: THE SITUATION IN THE NETHERLANDS AND ELSEWHERE [FOTOCHEMISCHE LUCHTVERONTREINIGING. HET ONSTAAN VAN FOTOCHEMISCHE LUCHTVERONTREINIGING: DE SITUATIE IN NEDERLAND EN ELDERS]
H. Nieboer and J. VanHam Aug. 1975 77 p refs In DUTCH
Sponsored in part by Min. van Volksgezondheid en Milieuhygiene
(TNO-CL-75/64) Avail: NTIS HC A05/MF A01

Photochemical air pollution from sunlight reacting with primary pollutants results in a number of secondary products causing chronic and acute effects in man, plants, and animals. The role of ozone concentration is discussed, as well as that of the contribution of typical emissions. Meteorological parameters are taken into account. ESA

N77-21739# Central Technical Inst. TNO, Apeldoorn (Netherlands).
LITERATURE SURVEY OF ATMOSPHERIC POLLUTANT EMISSIONS BY NATURAL PROCESSES IN THE NETHERLANDS [LITERATUURONDERZOEK NAAR EMISSIES VAN STOFFEN IN DE ATMOSFEER DOOR NATUURLIJKE PROCESSEN IN NEDERLAND]
G. Annokkee 27 Feb. 1975 35 p refs In DUTCH

(CTI-IV-75-01448) Avail: NTIS HC A03/MF A01

The processes under consideration occur in land or water, or in vegetation, without human interference. Some examples are bacterial decomposition of organic material in the ground and syntheses of organic compounds in plants. For each process, an indication is given of the source(s), order of magnitude of the emission, and atmospheric background concentration of the emitted pollutants. ESA

N77-21740# Research Triangle Inst., Research Triangle Park, N.C. Center for Technology Applications.

SUMMARY OF PARTICULATE AND SULFUR OXIDE EMISSION REDUCTIONS ACHIEVED NATIONWIDE FOR SELECTED INDUSTRIAL SOURCE CATEGORIES 1970 - 1975. VOLUME 1: SUMMARY

Martin F. Massoglia Nov. 1976 52 p ref Sponsored in part by Army

(Contract EPA-68-02-1325)

(PB-260549/1; EPA-340/1-76-008a-vol-1) Avail: NTIS HC A04/MF A01 CSCL 13B

The nationwide emission data on total suspended particulates and sulfur oxides from selected source categories for 1975, and the associated analysis to determine the progress made, nationwide, in meeting the ambient air quality standards for the two pollutants under study are updated. GRA

N77-21741# Research Triangle Inst., Research Triangle Park, N.C. Center for Technology Applications.

SUMMARY OF PARTICULATE AND SULFUR OXIDE EMISSION REDUCTIONS ACHIEVED NATIONWIDE FOR SELECTED INDUSTRIAL SOURCE CATEGORIES 1970 - 1975. VOLUME 2: CALCULATIONS

Martin F. Massoglia Nov. 1976 92 p refs Revised Sponsored in part by Army

(Contract EPA-68-02-1325)

(PB-260550/9; EPA-340/1-76-008b-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 13B

The detailed calculations, in appendix form, upon which nationwide emission inventories--actual, potential, and compliance--were based are given. GRA

N77-21742# GKY and Associates, Alexandria, Va.

ANALYSIS OF OIL SPILL TRENDS Final Report

G. K. Young, D. Evans, and R. U. Jettmar Aug. 1976 51 p refs

(Contract EQ6AC014)

(PB-260917/0) Avail: NTIS HC A04/MF A01 CSCL 13B

An analysis is made of national data on oil spills and cleanup to derive trends from incidents recorded from 1972 through 1975 in the Pollution Incident Reporting System (PIRS) file of the U.S. Coast Guard and the Spill Prevention, Control and Countermeasure (SPCC) file of the Environmental Protection Agency. GRA

N77-21743# Environmental Protection Agency, Research Triangle Park, N.C. Monitoring and Data Analysis Div.

AIR QUALITY DATA: 1974 SECOND QUARTER STATISTICS Final Report, Apr. - Jun. 1974

Oct. 1976 154 p refs

(PB-260630/9; EPA-450/2-76-021) Avail: NTIS HC A08/MF A01 CSCL 13B

This report is a statistical summary report on ambient air quality submitted to EPA from air monitoring operations of state, local, and federal networks in accordance with requirements of the Clean Air Act and EPA Regulations for State Implementation Plans (SIP's). These data represent all ambient air quality data sampled for pollutants that currently have National Ambient Air Quality Standards. GRA

N77-21744# Environmental Protection Agency, Research Triangle Park, N.C. Monitoring and Data Analysis Div.

AIR QUALITY DATA: 1971 ANNUAL STATISTICS Final Report

Oct. 1976 83 p refs

(PB-260629/1; EPA-450/2-76-020) Avail: NTIS HC A05/MF A01 CSCL 13B

The air quality statistics shown are produced directly from computer reports generated by EPA's on-line computer system. Some of the data in this publication were revised as a result of a recent effort to improve the quality of the past data. GRA

N77-21745# Environmental Protection Agency, Research Triangle Park, N.C. Monitoring and Data Analysis Div.

AIR QUALITY DATA: 1970 ANNUAL STATISTICS Final Report

Oct. 1976 58 p refs

(PB-260628/3; EPA-450/2-76-019) Avail: NTIS HC A04/MF A01 CSCL 13B

A statistical summary on ambient air quality is presented. The air quality statistics shown are produced directly from computer reports generated by EPA's online computer system. GRA

N77-21746# Environmental Protection Agency, Research Triangle Park, N.C. Monitoring and Data Analysis Div.

AIR QUALITY DATA: 1974 FOURTH QUARTER STATISTICS Final Report, Oct. - Dec. 1974

Oct. 1976 158 p refs

(PB-260631/7; EPA-450/2-76-023) Avail: NTIS HC A08/MF A01 CSCL 13B

A statistical summary is given on ambient air quality from air monitoring operations of state, local, and federal networks. These data represent all ambient air quality data sampled for pollutants that currently have National Ambient Air Quality Standards. GRA

N77-21747# Battelle-Northwest, Richland, Wash.

ELECTROSTATIC CAPTURE OF FINE PARTICLES IN FIBER BEDS Final Report, Jun. 1973 - Jun. 1975

D. L. Reid and L. M. Browne Jun. 1976 45 p

(Grant EPA-R-801581-02)

(PB-260590/5; EPA-600/2-76-132) Avail: NTIS HC A03/MF A01 CSCL 13B

Removal efficiency was determined as a function of particle resistivity, fiber bed resistivity, superficial gas velocity, and total concentration of the aerosol. Using a 12-in. thick polypropylene fiber bed, greater than 90 percent removal efficiency was reported for superficial bed velocities up to 300 ft/min. For a 6-in. bed, 90 percent removal was possible up to 200 ft/min. In both cases, the pressure drops for these systems were low (less than 1 in. H2O). A third bed was tested, comprised of a 6-in. Teflon fiber bed followed immediately by a 6-in. polypropylene bed. This composite 12-in. bed did not perform as well as the homogeneous 12-in. bed. GRA

N77-21748# Acurex Corp., Mountain View, Calif. Aerotherm Div.

PARTICULATE CONTROL IN ENERGY PROCESSES SYMPOSIUM

David E. Blake Sep. 1976 577 p refs Conf. proc. held at San Francisco, 11-13 May 1976

(Contract EPA-68-02-1318)

(PB-260499/9; EPA-600/7-76-010) Avail: NTIS HC A25/MF A01 CSCL 13B

Several recent developments in combustion technology have significantly increased the difficulty of particulate collection. There is an immediate problem with the rapidly increasing use of low-sulfur, high-ash Western coals. Because of the high mineral content of these coals, ash is produced at higher rates than for high-sulfur anthracite or bituminous coals. Compounding the problem, the low sulfur content decreases the effectiveness of electrostatic precipitators. The most severe problems arise when attempting to switch existing power plants to low-sulfur coals. There were six sessions, two panel discussions, and some 22 papers to consider these problems and their solutions. GRA

N77-21749# Air Pollution Systems, Inc., Seattle, Wash.

DEVELOPMENT PROGRAM FOR AN IONIZER-PRECIPITATOR FINE PARTICLE DUST COLLECTION SYSTEM AS APPLIED TO COAL-FIRED UTILITY STEAM GENERATORS. VOLUME 1: TECHNICAL AND ECONOMIC SUMMARY

James Schwab, David Goodson, Jack Cooper, Ronald Ehlenberger, and Peter Milovsoroff Oct. 1976 92 p refs 2 Vol.

(PB-260652/3; EPRI-FP-291-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 13A

The work was directed at developing more effective electrostatic precipitation of fine particulate, particularly of high resistivity fly ash, by imposing a high degree of charge on the particles. An electrode assembly results in an intensely ionized flue gas which leads to a particle charge as high as four times greater than is currently being achieved. Such an ionizer would be the first or charging stage of an improved 2-stage power station electrostatic precipitator immunized against high resistivity dust. Economic evaluations of the concept based on laboratory data are included. GRA

N77-21750# CONSAD Research Corp., Pittsburgh, Pa.
EVALUATION OF THE COST-EFFECTIVENESS OF NON-STRUCTURAL POLLUTION CONTROLS: A MANUAL FOR WATER QUALITY MANAGEMENT PLANNING Final Report
Fred Rueter and Cyril Fox 30 Apr. 1976 84 p refs
(Contract EPA-68-01-2699)
(PB-260513/7) Avail: NTIS HC A05/MF A01 CSCL 13B

A methodology for evaluating the economic costs of nonstructural pollution control techniques such as land use control is presented. Used instead of, or as a complement to, structural pollution controls, nonstructural alternatives can increase the effectiveness and/or decrease the costs of achieving environmental quality objectives. Chapters on legal feasibility, social impacts, and alternative compensatory mechanisms for nonstructural controls are included. GRA

N77-21751# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
OAQPS GUIDELINES: AEROS MANUAL SERIES. VOLUME 5: AEROS MANUAL OF CODES
Apr. 1976 563 p refs
(PB-259987/6; EPA-450/2-76-005-Vol-5; OAQPS-1.2-042) Avail: NTIS HC A24/MF A01 CSCL 13B

A complete compilation of codes required to prepare data for storage in AEROS (Aerometric and Emissions Reporting System) is provided. The codes included represent the special codes for NEDS, SAROAD, SOTDAT, OAMIS and SIPS as well as the geographic codes which are common to all the systems. GRA

N77-21752# Southern Research Inst., Birmingham, Ala.
PARTICULATE COLLECTION PROBLEMS IN CONVERTING TO LOW SULFUR COALS Conference Proceedings Report, Jan. - Dec. 1976
G. B. Nichols, comp. Oct. 1976 257 p refs
(Contract EPA-68-02-2114)
(PB-260498/1; EPA-600/7-76-016) Avail: NTIS HC A12/MF A01 CSCL 13B

Problems encountered in burning low sulfur coal in electrical utility power plant boilers are discussed. Operating experience with electrostatic precipitators (ESPs), fabric filter baghouses, and wet scrubbers for control of fly ash stack emissions and techniques for improving performance are described. Increasing the collection efficiency of ESPs for high resistivity fly ash by adding conditioning agents (e.g., sulfur trioxide, sulfuric acid, ammonium sulfate, sulfamic acid, and ammonia) to the flue gas is discussed, as are possible mechanisms for their action. A mathematical model is described that calculates the collection efficiency of an ESP as a function of particle size and operating conditions. GRA

N77-21753# Oklahoma Univ., Norman.
RESEARCH TO DEVELOP ECOLOGICAL STANDARDS FOR WATER RESOURCES Completion Report
George W. Reid Jul. 1976 315 p refs
(Contract DI-14-31-0001-5132)
(PB-260488/2; W77-01054; OWRT-B-032-Okla(1)) Avail: NTIS HC A14/MF A01 CSCL 13B

The standards are meaningful for and applicable to all the aquatic, land, and land-water interface environments. Steps were undertaken to establish ecological standards. The first one is the categorization of development levels of natural environment by measuring specific socioeconomic factors which are capable of delineating the human modification of the ecological system. The second one is the development of the ecological standards in response to various development levels so as to reflect the human influence on the ecological system. A unique and significant feature of the project is the combination of both socioeconomic and environmental considerations in the evaluation of the ecological system. GRA

N77-21754# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LONG-PATH MONITORING OF ATMOSPHERIC CARBON MONOXIDE: 1975 REGIONAL AIR POLLUTION STUDY, SAINT LOUIS, MISSOURI Interim Technical Report
R. T. Ku and E. D. Hinkley Apr. 1976 143 p refs Sponsored in part by EPA
(Grants NSF GI-37603; NSF ENV-73-07760-a01)
(PB-259117/0; NSF/RANN/IT/GI-37603-1; NSF/RA-760254) Avail: NTIS HC A07/MF A01 CSCL 13B

Data were analyzed with assigned error bars, and are presented on 24-hour daily plots. Correlations with meteorological data are continuing in order to obtain relevant information for pollution modeling. Some unexpected problems in calibration drift, non-linearity and interference were encountered this year, but they were successfully minimized in the field. As these problems were caused, in part, by use of some of the first commercially-produced diode lasers, they were expected to diminish as more satifactory manufacturing techniques are developed. GRA

N77-21755# Southwest Research Inst., San Antonio, Tex.
MEASUREMENT OF SULFATE AND SULFUR DIOXIDE IN AUTOMOTIVE EXHAUST Final Report, 28 Jun. 1974 - 31 Aug. 1976
Melvin N. Ingalls and Karl J. Springer Jun. 1976 317 p refs
(Contract EPA-68-03-2118)
(PB-260647/3; SwRI-AR-1124; EPA-460/3-76-015) Avail: NTIS HC A14/MF A01 CSCL 13B

The testing of four groups of cars for sulfate and sulfur dioxide exhaust emissions is reported. The collection and analytical techniques used for sulfate and sulfur dioxide are described. Emissions rates in grams per kilometer are presented for a variety of test cycles. In addition to sulfates and sulfur dioxide, gaseous emissions of hydrocarbons, carbon monoxide, and oxides of nitrogen are reported in grams per kilometer. Total particulate weight on the sulfate filter was determined on two of the groups of cars. For these same two groups of cars, the sampling tunnel residue from each test car was examined by X-ray fluorescent techniques. GRA

N77-21756# Aerospace Corp., El Segundo, Calif. Environmental and Energy Conservation Div.
INVENTORY OF COMBUSTION-RELATED EMISSIONS FROM STATIONARY SOURCES
Owen W. Dykema and Vernon E. Kemp Sep. 1976 178 p refs
(Grant EPA-R-803283-01)
(PB-261081/4; ATR-76(7549); EPA-600/7-76-012) Avail: NTIS HC A09/MF A01 CSCL 13B

The establishment of priorities for detailed studies of techniques for the control of combustion-related emissions from stationary sources is investigated. The inventory includes emissions of oxides of nitrogen, unburned hydrocarbons, carbon monoxide, and particulate, not only from recognized major stationary combustion sources, but also from other stationary source categories in which combustion plays a secondary role. Approximately 90 percent of all nitrogen oxide emissions and from 40 to 50 percent of unburned hydrocarbons, carbon monoxide, and particulate matter from stationary sources were identified. GRA

N77-21757# Environmental Research Center, Research Triangle Park, N. C. Office of Air Quality Planning and Standards.
AIR QUALITY DATA - 1975 SECOND QUARTER Final Report, Apr. - Jun. 1975
Oct. 1976 122 p refs
(PB-261077/2; EPA-450/2-76-024) Avail: NTIS HC A06/MF A01 CSCL 13B

A statistical summary report is given on ambient air quality submitted to EPA from air monitoring operations of state, local, and Federal networks in accordance with requirements of the Clean Air Act and EPA Regulations for State Implementation Plans (SIP's). These data represent all ambient air quality data

sampled for pollutants that currently have National Ambient Air Quality Standards. GRA

N77-21758# Monsanto Research Corp., Dayton, Ohio.
APPLICATION OF FOAM SCRUBBING TO FINE PARTICLE CONTROL, PHASE 1 Final Report, Jun. 1974 - Dec. 1975
T. E. Ctvrtnicek, T. F. Walburg, C. M. Moscowitz, and H. H. S. Yu May 1976 156 p refs
(PB-261075/6; MRC-DA-556; EPA-600/2-76-125) Avail: NTIS HC A08/MF A01 CSCL 13B

Detailed information concerning foam scrubber theory, experimentation, and economics is given. The theory pertains to mechanisms influencing the behavior of fine particles and the possibilities of their capture by foam. Collection efficiencies obtained on a bench scale foam scrubber show that foam scrubbing can be a viable fine particle control device. Preliminary economic analysis indicates that foam scrubbing can be competitive with other fine particle collection devices if the surfactant solution is recycled effectively. The report recommends that surfactant recycle be verified, using a bench scale foam scrubber. GRA

N77-21759# Environmental Research Center, Research Triangle Park, N. C. Office of Air Quality Planning and Standards.
AEROS MANUAL SERIES. VOLUME 3: SUMMARY AND RETRIEVAL
May 1976 596 p
(PB-260995/6; EPA-450/2-76-009-Vol-3; QAQPS-1.2-040-Vol-3) Avail: NTIS HC A25/MF A01 CSCL 13B

The reporting and analysis capabilities of the various AEROS systems are described. The reports available from each of the major systems are described, and their retrieval options are explained. This manual also describes the user access procedures for obtaining AEROS reports. Standard publications of NADB for providing quarterly or annual information on emissions and air quality are included. Specific examples of applications of AEROS data and the use of AEROS reports are given. The manual also gives an overview of the Comprehensive Data Handling System (COHS), which is an AEROS-related system for storing and reporting air quality and emissions data. GRA

N77-21760# Environmental Monitoring and Support Lab., Research Triangle Park, N.C. Statistical and Technical Analysis Branch.
AIR QUALITY DATA FOR METALS 1970 THROUGH 1974 FROM THE NATIONAL AIR SURVEILLANCE NETWORKS Final Report
Gerald G. Akland Aug. 1976 165 p ref
(PB-260905/5; EPA-600/4-76-041) Avail: NTIS HC A08/MF A01 CSCL 13B

The urban and nonurban concentrations of 11 metallic components of suspended particulate matter from samples gathered during calendar years 1970 through 1974 by the cooperating stations of the National Air Surveillance Network (NASN) are given. The data are presented as a quarterly composite concentration value for each site for each of the four quarters of the calendar year. GRA

N77-21761# Environmental Research Center, Research Triangle Park, N. C. Monitoring and Data Analysis Div.
AIR QUALITY DATA - 1974 THIRD QUARTER STATISTICS Final Report, Jul. - Sep. 1974
Oct. 1976 153 p refs
(PB-260882/6; EPA-450/2-76-022) Avail: NTIS HC A08/MF A01 CSCL 13B

A statistical summary report is presented on ambient air quality submitted to EPA from air monitoring operations of state, local, and Federal networks in accordance with requirements of the Clean Air Act and EPA Regulations for State Implementation Plans (SIP's). These data represent all ambient air quality data sampled for pollutants that currently have National Ambient Air Quality Standards. GRA

N77-21762# Mathtech, Inc., Princeton, N. J.
A COMPUTER SIMULATION MODEL--FOR ANALYZING MOBILE SOURCE AIR POLLUTION CONTROL STRATEGIES Final Report, Nov. 1974 - Aug. 1976
Sep. 1976 189 p refs
(Contract EPA-68-01-2952)
(PB-260877/6; EPA-600/5-76-010) Avail: NTIS HC A09/MF A01 CSCL 13B

A baseline, zero control strategy and four strategies of increasing stringency are defined and simulated over a ten-year horizon. One general conclusion suggested by the results of the test is that it is economically inefficient to impose the same program of controls in different urban regions. Another conclusion is that the control strategies are very sensitive to certain input data. GRA

N77-21763# Pacific Northwest Environmental Research Lab., Corvallis, Ore. Terrestrial Ecology Branch.
SUSCEPTIBILITY OF WOODY PLANTS TO SULFUR DIOXIDE AND PHOTOCHEMICAL OXIDANTS Final Report
Donald D. Davis (Pennsylvania State Univ., University Park) and Raymond G. Wilhour Sep. 1976 83 p refs
(PB-260881/8) Avail: NTIS HC A05/MF A01 CSCL 13B

The results of a detailed review of European and United States literature regarding the sensitivity of woody vegetation to sulfur dioxide, ozone, peroxyacetyl nitrate (PAN), or nitrogen oxides are presented. Reference is made to Russian, Japanese, and Austrian literature only when species examined are commercially important in the United States. The manner in which the original susceptibility data were collected may influence the relative position of a species in a composite susceptibility table. Therefore, many original tables are presented for individual interpretation of susceptibility. Composite summary susceptibility tables are also presented for each pollutant. GRA

N77-21764# GCA Corp., Bedford, Mass. Technology Div.
PRELIMINARY ENVIRONMENTAL ASSESSMENT OF THE CAFB Final Report, Aug. 1975 - May 1976
Arthur S. Werner, Charles W. Young, Mark I. Bornstein, Robert M. Bradway, and Michael T. Mills Oct. 1976 324 p refs
(Contract EPA-68-02-1316)
(PB-262001/1; GCA-TR-76-18-G; EPA-600/7-76-017) Avail: NTIS HC A14/MF A01 CSCL 13B

The Chemically Active Fluid Bed (CAFB) process was developed as a means to generate electrical energy from high sulfur, high metal heavy fuel oil. Fuel oil is fed continuously into a fluidized bed of limestone maintained at 870 C by preheated, substoichiometric air. The fuel oil entering the gasifier is vaporized, oxidized, cracked, and reduced to produce a low-Btu, low-sulfur gas which is then burned in a conventional boiler. Sulfur contained in the oil initially forms various gaseous compounds which then react with the bed limestone to yield solid calcium sulfide. The sulfided lime is cycled to a regeneration unit where it is oxidized to produce CaO which is returned to the gasifier and SO2 which is sent to a sulfur recovery unit. GRA

N77-21765# California Univ., Los Angeles.
PARAMETRIC STUDIES OF CATALYSTS FOR NOx CONTROL FROM STATIONARY POWER PLANTS Final Report, Mar. 1975 - Sep. 1976
Ken Nobe, George L. Bauerle, and S. C. Wu Oct. 1976 245 p refs
(Grant EPA-R-803653-01)
(PB-261289/3; EPA-600/7-76-026) Avail: NTIS HC A11/MF A01 CSCL 13B

A study of vanadia-alumina and iron oxide-chromium oxide-alumina catalysts for the reduction of NO with NH3 in simulated flue gas is reported. Optimum catalyst compositions were 15% V2O5 on Al2O3 and 10% Fe-Cr oxides on Al2O3 with an Fe/Cr ratio of 1/9, respectively. Both catalysts were selective for the reduction of NO to N2 in the presence of O2. Both were shown to be sulfur-resistant during total periods of operation of 648 hours for V2O5 and 1,052 hours Fe-Cr in the presence of SOx. Typical conversion levels for V2O5 and Fe-Cr catalysts operating at 400 C in simulated flue gas containing 1,000 ppm NO, 1,000 ppm NH3, in the presence of SOx, were about 90 and 80%, respectively, at 20,000 per hour space velocity. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N77-21766*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
STUDY OF THE RELATION BETWEEN Pc 3 MICROPULSATIONS AND MAGNETOSHEATH FLUCTUATIONS AND OF THE MULTISATELLITE, MULTIMEASUREMENT INVESTIGATION OF THE EARTH'S BOW SHOCK Space Sciences Dept.
30 Dec. 1976 60 p refs
(Contract NASw-2877)
(NASA-CR-152646; Rept-29506-6004-RU-00) Avail: NTIS HC A04/MF A01 CSCL 04A

The structure and direction of bow shock waves and the occurence of Pc 3, 4 micropulsations were investigated. An observational description is given of a quasi-parallel structure in a plasma parameter regime. The use of approximation to estimate the thickness of thin, nearly perpendicular bow shocks at supralaminar Mach numbers is discussed. The pattern of energies of backstreaming protons in the foreshock are predicted. Author

N77-21767*# National Aeronautics and Space Administration, Washington, D. C.
THE NASA PROGRAM ON UPPER ATMOSPHERIC RESEARCH Program Plan
Jun. 1976 60 p refs
(NASA-TM-X-74608) Avail: NTIS HC A04/MF A01 CSCL 04A

The purpose of the NASA Upper Atmospheric Research Program is to develop a better understanding of the physical and chemical processes that occur in the earth's upper atmosphere with emphasis on the stratosphere. Author

N77-21768*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SIMULATION FOR GRAVITY FINE STRUCTURE RECOVERY FROM HIGH-LOW GRAVSAT SST DATA Final Report
R. H. Estes and E. R. Lancaster Dec. 1976 132 p refs Prepared in cooperation with Business and Technological Systems, Inc., Seabrook, Md.
(Contract NAS5-22804)
(NASA-TM-X-72607; BTS-TR-76-37) Avail: NTIS HC A07/MF A01 CSCL 08N

Covariance error analysis techniques were applied to investigate estimation strategies for the high-low SST mission for accurate local recovery of gravitational fine structure, considering the aliasing effects of unsolved for parameters. Surface density blocks of 5 deg x 5 deg and 2 1/2 deg x 2 1/2 deg resolution were utilized to represent the high order geopotential with the drag-free GRAVSAT configured in a nearly circular polar orbit at 250 km. altitude. GEOPAUSE and geosynchronous satellites were considered as high relay spacecraft. It is demonstrated that knowledge of gravitational fine structure can be significantly improved at 5 deg x 5 deg resolution using SST data from a high-low configuration with reasonably accurate orbits for the low GRAVSAT. The gravity fine structure recoverability of the high-low SST mission is compared with the low-low configuration and shown to be superior. Author

N77-21769*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECT OF SURFACE ROUGHNESS ON THE MICROWAVE BRIGHTNESS TEMPERATURE OF SOILS
B. J. Choudhury (Computer Sciences Corp., Silver Spring, Md.), T. J. Schmugge, and A. Chang [1977] 19 p refs Submitted for publication
(NASA-TM-X-71282; X-913-76-265) Avail: NTIS HC A02/MF A01 CSCL 08M

The effect of surface roughness on the brightness temperature of a moist terrain was studied through the modification of Fresnel reflection coefficient and using the radiative transfer equation. Model calculations are in good qualitative agreement with the observed dependence of the brightness temperature on the moisture content in the surface layer. Author

N77-21770*# Control Data Corp., Minneapolis, Minn. Research Div.
VARIABILITY AND TRANSPORT OF OZONE AT THE TROPOPAUSE FROM THE FIRST YEAR OF GASP DATA
G. D. Nastrom Feb. 1977 32 p refs
(Contract NAS2-7807)
(NASA-CR-135176; RR-4) Avail: NTIS HC A03/MF A01 CSCL 04A

The relationships of ozone near the tropopause with potential vorticity temperature, and distance from the tropopause are examined. Data are also used to estimate the vertical and horizontal fluxes of ozone near the tropopause. The present estimates of the total flux of ozone into the troposphere verify the model results. Although the distribution of flux between mean motions and diffusion is different and thus suggests that models with coarse horizontal resolution must continue to parameterize much vertical transport by diffusion coefficients. Monthly estimates of the horizontal transient eddy flux of ozone are generally smaller than seasonal or yearly results based on ozonesonde data. This is perhaps because the present estimates are made over monthly periods to reduce the influence of correlation between the annual variations in ozone and meridional wind. The available data support the hypothesis that transient eddy fluxes of ozone have large longitudinal variations. Author

N77-21771*# Ohio State Univ. Research Foundation, Columbus.
GLOBAL PLATE TECTONICS AND THE SECULAR MOTION OF THE POLE
Tomas Soler Feb. 1977 224 p refs
(Grant NGR-36-008-204; OSURF Proj. 3820-A1)
(NASA-CR-152662; Rept-252) Avail: NTIS HC A10/MF A01 CSCL 08E

Astronomical data compiled during the last 70 years by the international organizations providing the coordinates of the instantaneous pole clearly shows a persistent drift of the mean pole. The differential contributions to the earth's second-order tensor of inertia were obtained and applied, resulting in no significant displacement of the earth's principal axis. In view of the above, the effect that theoretical geophysical models for absolute plate velocities may have on an apparent displacement of the mean pole as a consequence of station drifting was analyzed. The investigation also reports new values for the crustal tensor of inertia (assuming an ellipsoidal earth) and the orientation of its axis of figure, reopening the old speculation of a possible sliding of the whole crustover the upper mantle, including the supporting geophysical and astronomic evidence. Author

N77-21772# Brookhaven National Lab., Upton, N.Y.
OBSERVATION OF ATMOSPHERIC INTERNAL GRAVITY WAVES IN A TURBULENT COASTAL ENVIRONMENT
S. SathuRaman 1976 10 p refs Presented at Conf. on Coastal Meteorol., Virginia Beach, Va., 21 Sep. 1976
(Contract E(30-1)-16)
(BNL-21598; Conf-760918-1) Avail: NTIS HC A02/MF A01

The observations of internal gravity waves very near the surface (within a height of 24 m) in the surface-based inversion of the marine boundary layer are described. There are several conflicting features that would probably affect the generation of internal gravity waves in the marine surface layer: nearness of the boundary causes increased turbulence; smooth surface decreases turbulence; in a large body of water diurnal variation in surface temperature is minimal; and wind generated surface waves contribute to atmospheric turbulence at certain frequencies. ERA

N77-21773# State Univ. of New York, Stony Brook. Dept. of Mechanical Engineering.
CHEMICALLY REACTIVE TURBULENT PLUMES
Edward E. OBrien, Ronald E. Meyers (Brookhaven Natl. Lab., Upton, New York), and Carmen M. Benkovitz (Brookhaven Natl. Lab., Upton, New York) 1976 5 p refs Presented at the Symp. on Atmospheric Turbulence, Diffusion, and Air Quality, Raleigh, North Carolina, 19 Oct. 1976
(Contract E(30-1)-16)

(BNL-21483; Conf-761003-3) Avail: NTIS HC A02/MF A01

The evolution of a reactive plume of nitrous oxide in the presence of atmospheric ozone is described. Description of the reacting plume is compared to existing models of non-reactive plume advection, which are well established in the meteorological literature. ERA

N77-21774# Los Alamos Scientific Lab., N. Mex.

GEOMAGNETIC ORIENTED ELECTROMAGNETIC RADIATION IN THE IONOSPHERE

C. U. Benton, H. M. Fowles (Denver Univ., Colo.), and P. K. Goen (Sandia Labs., Albuquerque, N. Mex.) Aug. 1976 6 p refs

(Contract W-7405-eng-36)

(LA-6469-MS) Avail: NTIS HC A02/MF A01

Strong bursts of electromagnetic radiation were observed in the ionosphere during the Waso rocket Electromagnetic Pulse (EMP) experiment. The pulses have a frequency content from below 20 MHz above 70 MHz. They vary in duration between 5 micrometers and 2 ms and in peak amplitudes of 2 mV/m to greater than 200 mV/m. These pulses show a high degree of geomagnetic correlation and are of unknown origin. ERA

N77-21775# Freie Univ., Berlin (West Germany). Inst. fuer Geophysik.

GEOPHYSICAL DATA, NO. 5: UNIVERSAL TIME VARIATION OF GEOMAGNETIC ACTIVITY AS MAGNETOSPHERIC MODULATION EFFECT [GEOPHYSIKALISCHE ABHANDLUNGEN, HEFT 5: DER WELTZEITGANG DER ERDMAGNETISCHEN AKTIVITAET ALS MAGNETOSPHAERISCHER MODULATIONSEFFEKT]

Detlef Damaske Verlag von Dietrich Reimer 1976 76 p refs In GERMAN; ENGLISH summary

Avail: NTIS HC A05/MF A01

The daily revolution of the geomagnetic dipole axis around the earth's axis of rotation causes periodic daily variations in the interaction between the solar wind and the magnetosphere, leading to a superimposed modulation of geomagnetic activity according to universal time (UT variation). Harmonic analysis of a 14-year series of Mayaud's 3-hour indices Km confirms and ensures earlier results for the 24-hour universal wave at the solstices and for the 12-hour universal wave at the equinoxes. The increased amount of data offers the opportunity to further subdivide the year into eight groups of days for investigating the seasonal changes of these universal waves. Both diurnal and semidiurnal UT waves come out as sine waves with constant phase but modulated amplitude. The annual amplitude modulation of the 24-hour universal wave can be represented in good approximation as an annual sine wave beginning on April 1, i. e., with a phase lag of 11 days relative to the vernal equinox. As a daily pendant to this phase lag of the annual amplitude modulation, the UT variation itself shows its daily maximum about 15 min earlier than the expected times. Both effects are supposedly due to aberration of the solar wind. All results obtained from analysis of the worldwide indices Km agree very well with the conception of a magnetospheric modulation governed by a sine square-law of the solar wind angle (angle between the solar wind direction and the dipole axis of the earth). Author (ESA)

N77-21776# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

AN OVERVIEW BY PIONEERS OBSERVATIONS OF THE DISTANT GEOMAGNETIC TAIL

U. Villante Jul. 1976 51 p refs

(LPS-76-20) Avail: NTIS HC A04/MF A01

Detailed reinvestigations of Pioneer 8 and Pioneer 7 observations of the geomagnetic tail at large geocentric distances (about 500 and about 1,000 Re, respectively) suggest that that far from the earth the distant tail still preserves most of its near earth typical features. In particular, the presence of low density plasma fluxes in the region of expected tail (which, in the past, were considered a strident deviation from typical near earth conditions) can be interpreted in terms of an extension of the plasma mantle to a large fraction of the distant tail. The distant neutral sheet, moreover, is still oriented along the tail midplane; regular reconnection processes of opposite field lines are also extensively observed. Close to the neutral layer, a higher velocity plasma component is often superimposed to the tail plasma protons. The regions of tail observations might still be consistent with a cylindrical tail geometry; nevertheless, the existence of a superimposed, fragmented tail structure cannot be excluded. Author (ESA)

N77-21777# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

ON THE AUTOCORRELATION AND PREDICTION OF AVERAGED SEQUENCES WITH APPLICATION TO GRAVITATIONAL DATA ANALYSIS

G. V. Pallottino and G. Pizzella Oct. 1976 17 p

(LPS-76-28) Avail: NTIS HC A02/MF A01

The exact expression of the autocorrelation function was derived for the sequence obtained by averaging a data sequence with known autocorrelation. This result was applied to the analysis of the data of the gravitational wave experiment and provided the correct evaluation of the optimum averaging time for the detection of short gravitational pulses. The theoretical results are in very good agreement with the experimental data obtained with a small (20 kg) test antenna operated at 4.2 K.

Author (ESA)

N77-21778# Kiruna Geophysical Inst. (Sweden).

TWO-Hz INFRASOUND AND GEOMAGNETIC ACTIVITY

Hans Westin Oct. 1976 20 p refs Sponsored in part by Swed. Nat. Sci. Res. Council

(Grant NSF GA-41918)

(KGI-76-2) Avail: NTIS HC A02/MF A01

Signals on the 2 Hz infrasound recordings at Kiruna were statistically studied. Recordings from magnetically quiet periods were compared with active periods, and it has been found that more signals are received from the north during active periods than during quiet periods if one only considers signals with horizontal phase velocities above 550 m/s. The azimuth distribution is distorted by background signals from NW, but there is a tendency for waves observed during active period to arrive from NE in the evening and from NW in the morning.

Author (ESA)

N77-21779# Kiruna Geophysical Inst. (Sweden).

INFRASOUND WAVES OF AURORAL ORIGIN

Hans Westin Oct. 1976 48 p refs Sponsored in part by Swed. Nat. Sci. Res. Council

(Grant NSF GA-41918)

(KGI-76-4) Avail: NTIS HC A03/MF A01

The infrasonic waves associated with the supersonic motion of auroral electrojets and auroral forms that were observed in the auroral zone for the past decade are dealt with. Most of the knowledge of these waves is based on observations from the low frequency passband from 0.1 to 0.01 Hz. These observations have revealed that infrasonic waves are associated with equatorward supersonic motion of auroral arcs and fast moving eastward surges, but not with the rapid poleward movement of the arcs. A combination of Lorentz force and Joule heating are suggested in theoretical works for coupling energy from the auroral electrojets to the neutral gas. Theoretical works also show that the Lorentz force and the Joule dissipation terms add when the motion is equatorward and subtract when it is poleward. As these terms are of comparable magnitude, this effect may in part explain the observed assymetry in the direction of the auroral infrasonic waves. Author (ESA)

N77-21780*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

VLF EMISSIONS ASSOCIATED WITH ENHANCED MAGNETOSPHERIC ELECTRONS Progress Report

Roger R. Anderson and Kaichi Maeda Feb. 1976 60 p refs Prepared in cooperation with Iowa Univ.

(Contracts NAS5-11167; N00014-76-C-0016)

(NASA-TM-X-74643; AD-A031354; U-of-Iowa-76-8) Avail: NTIS HC A04/MF A01 CSCL 04/1

During periods of geomagnetic disturbances, VLF emissions and enhancements of low energy electrons are simultaneously observed by the equatorial orbiting Explorer 45 satellite. These events are characterized by the following features: (1) the VLF emissions occur outside the plasmasphere in the nightside of the magnetosphere; (2) the VLF emissions consist of two frequency

regimes, one below the local electron gyrofrequency f sub-g and the other above f sub-g; (3) the VLF emissions below f sub-g are relatively broadband whistlermode waves characteristic of chorus and frequently have a conspicuous band of missing emissions near f sub-g; (4) the emissions above f sub-g are electrostatic and typically have components near 3f sub-g/2, and occasionally, higher frequency components are also observed; (5) the onset of the emissions coincides with abrupt increases outside the plasmasphere (L greater than or equal to 4) in 1-10 keV electrons to intensities of the order of 10 to the 8-th power electrons/sq cm/sec/ster/keV; less pronounced enhancements sometimes occur for electrons with energies as high as 70 keV; and (6) the cessation of the emissions coincides with a drop in the electron intensities to their pre-enhancement levels which are of the order to 10 to the 6-th power electrons/sq cm/sec/ster/keV or less. This drop in low energy electron intensities occurs before or when the satellite crosses the plasmapause back into the plasmasphere. GRA

N77-21781# California Univ., Berkeley. Earthquakes Engineering Research Center.

TIME AND FREQUENCY DOMAIN ANALYSES OF THREE DIMENSIONAL GROUND MOTIONS SAN FERNANDO EARTHQUAKES

Tetsuo Kubo and Joseph Penzien Mar. 1976 237 p refs
(Grant NSF GK-36387)
(PB-260556/6; EERC-76-6) Avail: NTIS HC A11/MF A01 CSCL 08K

Principal directions and components are generated for the strong ground motions recorded during the San Fernando earthquake of February 9, 1971. Characteristics of the principal components are investigated using the moving-window technique applied in both the time and frequency domains. A nonstationary random process is defined reflecting the same characteristics in a statistical sense. A computer program for generating principal directions and components of motion, wave-form characteristics, and sample accelerograms from the nonstationary random process is listed. GRA

N77-21782# National Science Foundation, Washington, D. C.

EARTHQUAKE PREDICTION AND HAZARD MITIGATION: OPTIONS FOR USGS AND NSF PROGRAMS Final Report

15 Sep. 1976 113 p refs Prepared in cooperation with Geol. Survey, Washington, D. C.
(PB-258451/4; OAD/STIA-76-1) Avail: NTIS HC A06/MF A01 CSCL 08K

A plan is presented based upon staff working papers, two Advisory Group meetings (June and August 1976), input from Advisory Group members and subpanels, and comments, suggestions and criticism received from others. Contents include 4 chapters: (1) introduction, including list from Advisory Group members; (2) brief assessment of available social, political, economic measures for mitigating impacts of earthquakes and the current state of the technological basis for these measures; (3) discussion of current earthquake research efforts and options for future augmentation of earthquake research, including activities, funding levels, technical milestones, and public benefits; and (4) discussion of the efforts and options for improving utilization of research results and coordination mechanisms. The document builds upon numerous studies of the earthquake problem and analyses of strategies for response to it that have already been made. Some of the most significant of these are listed in Appendix 1. GRA

N77-21783# Geological Survey, Menlo Park, Calif.

APPLICATION OF STRESS-STRAIN RELATIONS IN NONLINEAR GROUND-MOTION ANALYSES Final Report

Albert T. F. Chen Oct. 1976 51 p refs
(PB-260644/0; USGS-GD-76-016) Avail: NTIS HC A04/MF A01 CSCL 08M

The sensitivity of computations of nonlinear, seismic responses of horizontally layered soil deposits to the stress-strain relation assumed is analyzed. In considering one-dimensional shear response of several typical soil deposits, a variety of stress-strain relations are assumed for the soil. These stress-strain relations include the hyperbolic relation by Hardin and Drnevich, the Ramberg-Osgood approximation, an empirical relation by Seed and Idriss, and some additional variations from these relations. A nonlinear, analytical procedure that considers the tangent shear modulus and the hysteretic damping of soils is applied to compute the surface response of these deposits. Responses computed using each stress-strain relation are presented and compared for each of the soil deposits. GRA

N77-21784# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.

STRONG MOTION EARTHQUAKE ACCELEROGRAMS, INDEX VOLUME

D. E. Hudson Aug. 1976 76 p refs
(Grant NSF AEN-71-01825-A05)
(PB-260929/5; EERL-76-02) Avail: NTIS HC A05/MF A01 CSCL 08K

Cross-referenced index lists are supplied which will facilitate the location of earthquake records from particular earthquakes and sites. These lists and the accompanying maps will also serve as a complete description of the location of all stations. A secondary purpose is to collect in one place various corrections, addenda, and supplementary information which should assist research workers in making use of the data. GRA

N77-21785# Saint Louis Univ., Mo. Dept. of Earth and Atmospheric Sciences.

RESEARCH IN SEISMOLOGY: EARTHQUAKE MAGNITUDES Final Report, 1 Jul. 1973 - 30 Sep. 1976

Otto W. Nuttli, So Gu Kim, Huei-Yuin Wen, and John A. Wagner 11 Oct. 1976 52 p refs
(Contract F19628-73-C-0269; ARPA Order 1795)
(AD-A032699; AFGL-TR-76-0238) Avail: NTIS HC A04/MF A01 CSCL 17/10

This report presents results of a search for earthquakes in Eurasia that have anomalous ratios of body-wave magnitude to surface-wave magnitude values. Results of a study of mainshock-aftershock sequences are also provided. Earthquakes occurring along the plate margin of Eurasia were found to be non-anomalous. Anomalous earthquakes are confined to the continental interior, with about 18% of the intraplate earthquakes studied having anomalous (m sub b): (M sub S) values; the anomalus events extend from southern Europe to eastern Asia. Anomalous earthquakes are often found among the aftershocks of mainshock-aftershock intraplate earthquake sequences. Focal depth and focal mechanisms of anomalous and non-anomalous earthquakes were found to be the same, so that depth and mechanism variations do not explain the anomalies. It was also found that anomalous earthquakes had shorter P-wave spectral corner periods than non-anomalous earthquakes of the same surface-wave magnitude or seismic moment. It appears to be especially difficult to discriminate between a small-magnitude aftershock of an intraplate earthquake and a small to intermediate yield explosion detonated within a few hours or days of the mainshock. GRA

N77-21786# Texas Instruments, Inc., Dallas. Equipment Group.

COMBINED STUDIES Final Report, 23 Apr. 1973 - 31 Aug. 1976

Lawrence S. Turnbull, Jr. and David Sun 31 Aug. 1976 66 p refs
(Contract F44620-73-C-0055; ARPA Order 1827)
(AD-A033463; TI-ALEX(02)-FR-76-01; AFOSR-76-1262TR)
Avail: NTIS HC A04/MF A01 CSCL 17/10

This final report summarizes the material covered in six previous semiannual technical reports, and discusses the conclusions obtained from these studies. The counterevasion studies were concerned with the evaluation and application of two techniques: complex cepstrum analysis and eigenspectrum analysis. These techniques were used to separate interfering seismic signals in order to distinguish underground nuclear explosions hidden in larger earthquakes, for the identification of sequential underground nuclear explosions, and for the detection of the pP depth phase. In addition, a new study on the effect of sampling rate on the detection of the pP depth phase is also presented. The main topic of the far-field research was directed toward the determination of seismic source parameters using teleseismic surface wave spectra. Techniques were developed to fit theoretical spectra generated using a double couple source in a layered half-space to observed spectra corrected to a near

source reference point. Several procedures were used to correct the observed spectra for effective attenuation. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N77-21787*# Lockheed Electronics Co., Houston, Tex. Life Sciences Applications Dept.
EXTENSION OF SURFACE DATA BY USE OF METEOROLOGICAL SATELLITES
L. E. Giddings Sep. 1976 36 p refs
(Contract NAS9-12200)
(NASA-CR-151290; LEC-8377; JSC-11139) Avail: NTIS HC A03/MF A01 CSCL 04B

Ways of using meteorological satellite data to extend surface data are summarized. Temperature models are prepared from infrared data from ITOS/NOAA, NIMBUS, SMS/GOES, or future LANDSAT satellites. Using temperatures for surface meteorological stations as anchors, an adjustment is made to temperature values for each pixel in the model. The result is an image with an estimated temperature for each pixel. This provides an economical way of producing detailed temperature information for data-sparse areas, such as are found in underdeveloped countries. Related uses of these satellite data are also given, including the use of computer prepared cloud-free composites to extend climatic zones, and their use in discrimination of reflectivity-thermal regime zones. Author

N77-21788*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALL-WEATHER ICE INFORMATION SYSTEM FOR ALASKAN ARCTIC COASTAL SHIPPING
R. T. Gedney, R. J. Jirberg, R. J. Schertler, R. A. Mueller, T. L. Chase, I. Kramarchuk, L. A. Nagy, R. A. Hanlon, and H. Mark 1977 14 p refs Presented at 9th Ann. Offshore Technology Conf., Houston, Tex., 2-5 May 1977
(NASA-TM-X-73619; E-9108) Avail: NTIS HC A02/MF A01 CSCL 04B

A near real-time ice information system designed to aid arctic coast shipping along the Alaskan North Slope is described. The system utilizes a X-band Side Looking Airborne Radar (SLAR) mounted aboard a U.S. Coast Guard HC-130B aircraft. Radar mapping procedures showing the type, areal distribution and concentration of ice cover were developed. In order to guide vessel operational movements, near real-time SLAR image data were transmitted directly from the SLAR aircraft to Barrow, Alaska and the U.S. Coast Guard icebreaker Glacier. In addition, SLAR image data were transmitted in real time to Cleveland, Ohio via the NOAA-GOES Satellite. Radar images developed in Cleveland were subsequently facsimile transmitted to the U.S. Navy's Fleet Weather Facility in Suitland, Maryland for use in ice forecasting and also as a demonstration back to Barrow via the Communications Technology Satellite. Author

N77-21789*# Environmental Research and Technology, Inc., Concord, Mass.
HIGH RESOLUTION RADIOMETRIC MEASUREMENTS OF CONVECTIVE STORMS DURING THE GATE EXPERIMENT
Grace Fowler and Anthony S. Lisa Sep. 1976 63 p refs
(Contract NAS5-20746)
(NASA-CR-152473; P-1282) Avail: NTIS HC A04/MF A01 CSCL 04B

Using passive microwave data from the NASA CV-990 aircraft and radar data collected during the Global Atmospheric Research Program Atlantic Tropical Experiment (GATE), an empirical model was developed relating brightness temperatures sensed at 19.35 GHz to surface rainfall rates. This model agreed well with theoretical computations of the relationship between microwave radiation and precipitation in the tropics. The GATE aircraft microwave data was then used to determine the detailed structure of convective systems. The high spatial resolution of the data permitted identification of individual cells which retained unique identities throughout their lifetimes in larger cloud masses and allowed analysis of the effects of cloud merger. Author

N77-21790*# Dayton Univ. Research Inst., Ohio.
METEOROLOGICAL NEEDS OF THE AVIATION COMMUNITY
James K. Luers Mar. 1977 82 p
(NASA-CR-150217) Avail: NTIS HC A05/MF A01 CSCL 04B

A study was conducted to determine the important meteorological needs of the aviation community and to recommend research in those areas judged most beneficial. The study was valuable in that it provided a comprehensive list of suspected meteorological deficiencies and ideas for research programs relative to these deficiencies. The list and ideas were generated from contacts with various pilots, air traffic controllers, and meteorologists. Author

N77-21791*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
JSC THUNDERSTORM EXPERIMENT RESULTS
Mar. 1977 27 p
(NASA-TM-X-74682; JSC-12509) Avail: NTIS HC A03/MF A01 CSCL 04B

To gain more insight into the various effects of lightning and thunderstorms on future shuttle vehicle launch and landing operations, an experiment was conducted to obtain data on the nature of electric fields in the vicinity of thunderstorms and particularly in the region of cumulonimbus cloud anvils during their various stages of build-up, maturity, and dissipation. These data supplement the airborne electric field data collected during the summer of 1975 in support of the Apollo Soyuz Test Project and the Viking launches. A Learjet aircraft was outfitted with four special electric field meters for collecting data. The onboard aircraft radar was also used to investigate cells embedded in large thunderstorm systems such as those found in frontal and squall line activities. Data were collected from 33 storm cells and used to establish a launch criteria to preclude triggering lightning during shuttle vehicle operations in close proximity to thunderstorms. Author

N77-21792# National Climatic Center, Asheville, N. C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 11, NO. 1 Quarterly Issue, Jan. - Mar. 1974
1976 654 p
Avail: NTIS HC A99/MF A01; National Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications. Hard copy subscription price: $44.80 a year, $11.20 quarterly

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations, and current month means and standard deviations are also presented. Author

N77-21793# National Climatic Center, Asheville, N. C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 11, NO. 2 Quarterly Issue, Apr. - Jun. 1974
1976 574 p
Avail: NTIS HC A24/MF A01; National Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications. Hard copy subscription price: $44.80 a year, $11.20 quarterly
For abstract, see N77-21792.

N77-21794# National Climatic Center, Asheville, N. C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 11, NO. 3 Quarterly Issue, Jul. - Sep. 1974
1976 492 p
Avail: NTIS HC A21/MF A01; National Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications. Hard copy subscription price: $44.80 a year, $11.20 quarterly
For abstract, see N77-21792.

N77-21795# National Climatic Center, Asheville, N. C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 11, NO. 4 Quarterly Issue, Oct. - Dec. 1974
1976 589 p
Avail: NTIS HC A25/MF A01; National Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications. Hard

copy subscription price $44.80 a year, $11.20 quarterly
For abstract, see N77-21792.

N77-21796# National Climatic Center, Asheville, N. C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 12, NO. 1 Quarterly Issue, Jan. - Mar. 1975
1976 570 p
Avail: NTIS HC A24/MF A01; National Climatic Center, Federal Building, Asheville, N. C. 28801 Attn: Publications. Hard copy subscription price: $44.80 a year, $11.20 quarterly
For abstract, see N77-21792.

N77-21797# National Climatic Center, Asheville, N. C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 12, NO. 2 Quarterly Issue, Apr. - Jun. 1975
1976 515 p
Avail: NTIS HC A22/MF A01; National Climatic Center, Federal Building, Asheville, N. C. 28801 Attn: Publications. Hard copy subscription price: $44.80 a year, $11.20 quarterly
For abstract, see N77-21792.

N77-21798# National Climatic Center, Asheville, N. C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 12, NO. 3 Quarterly Issue, Jul. - Sep. 1976
1976 497 p
Avail: NTIS HC A17/MF A01; National Climatic Center, Federal Building, Asheville, N. C. 28801 Attn: Publications. Hard copy subscription price: $44.80 a year, $11.20 quarterly
For abstract, see N77-21792.

N77-21799# National Climatic Center, Asheville, N. C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 12, NO. 4 Quarterly Issue, Oct. - Dec. 1975
1976 572 p
Avail: NTIS HC A24/MF A01; National Climatic Center, Federal Building, Asheville, N. C. 28801 Attn: Publications. Hard copy subscription price: $44.80 a year, $11.20 quarterly
For abstract, see N77-21792.

N77-21800# National Aeronautical Establishment, Ottawa (Ontario).
EXAMINATION OF GRADIENT-TRANSFER THEORY FOR VERTICAL DIFFUSION OVER MESOSCALE DISTANCES USING INSTRUMENTED AIRCRAFT
R. S. Crabbe Aug. 1976 56 p refs
(LTR-UA-37) Avail: NTIS HC A04/MF A01

Four mesoscale dispersion experiments are described, in three of which the predictions of gradient transfer theory are compared to airborne gas chromatographic measurements in a tracer gas plume. Crosswind sampling was performed, while in two experiments concurrent aircraft turbulence measurements were made to determine the vertical eddy diffusivities over the test range. Good agreement is demonstrated between theory and measurement of the crosswind integrated vertical concentration profile at 30 km when the aircraft measured eddy diffusivity profile is used. An extension of surface layer theory to the inversion base is presented which leads to equally good prediction of the GC data in all the experiments including those in which no turbulence measurements were made. By contrast, the data are not predicted by the Gaussian plume model, thus supporting the recent atmospheric diffusion analyses of Lamb et al. Author

N77-21801*# Tennessee Univ. Space Inst., Tullahoma.
WIND SHEAR AND WET AND DRY THERMODYNAMIC INDICES AS PREDICTORS OF THUNDERSTORM MOTION AND SEVERITY AND APPLICATION TO THE AVE 4 EXPERIMENTAL DATA
James R. Connell and Lillian Ey Mar. 1977 116 p refs
(Contract NAS8-31718)
(NASA-CR-150220) Avail: NTIS HC A06/MF A01 CSCL 04B

Two types of parameters are computed and mapped for use in assessing their individual merits as predictors of occurrence and severity of thunderstorms. The first group is comprised of equivalent potential temperature, potential temperature, water vapor mixing ratio, and wind speed. Equivalent potential temperature maxima and strong gradients of equivalent potential temperature at the surface correlate well with regions of thunderstorm activity. The second type, comprised of the energy index, shear index, and energy shear index, incorporates some model dynamics of thunderstorms, including nonthermodynamic forcing. The energy shear index is found to improve prediction of tornadic and high-wind situations slightly better than other indices. It is concluded that further development and refinement of nonthermodynamic aspects of predictive indices are definitely warranted. Author

N77-21802*# Texas A&M Univ., College Station.
ATMOSPHERIC ENERGETICS IN REGIONS OF INTENSE CONVECTIVE ACTIVITY Final Report
Henry E. Fuelberg Washington NASA Mar. 1977 149 p refs
(NAS8-31773)
(NASA-CR-2826; M-213) Avail: NTIS HC A07/MF A01 CSCL 04B

Synoptic-scale budgets of kinetic and total potential energy are computed using 3- and 6-h data at nine times from NASA's fourth Atmospheric Variability Experiment (AVE IV). Two intense squall lines occurred during the period. Energy budgets for areas that enclose regions of intense convection are shown to have systematic changes that relate to the life cycles of the convection. Some of the synoptic-scale energy processes associated with the convection are found to be larger than those observed in the vicinity of mature cyclones. Volumes enclosing intense convection are found to have large values of cross-contour conversion of potential to kinetic energy and large horizontal export of kinetic energy. Although small net vertical transport of kinetic energy is observed, values at individual layers indicate large upward transport. Transfer of kinetic energy from grid to subgrid scales of motion occurs in the volumes. Latent heat release is large in the middle and upper troposphere and is thought to be the cause of the observed cyclic changes in the budget terms. Total potential energy is found to be imported horizontally in the lower half of the atmosphere, transported aloft, and then exported horizontally. Although local changes of kinetic energy and total potential energy are small, interaction between volumes enclosing convection with surrounding larger volumes is quite large. Author

N77-21803# National Oceanic and Atmospheric Administration, Washington, D. C. National Severe Storms Lab.
EVALUATION OF A REMOTE WEATHER RADAR DISPLAY. VOLUME 2: COMPUTER APPLICATIONS FOR STORM, TRACKING AND WARNING Final Report, May 1975 - Dec. 1976
W. David Zittel Dec. 1976 128 p refs 2 Vol.
(Contract DOT-FA74WAI-440)
(AD-A035034/8; FAA-RD-75-60-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 04/2

Tests with a remote radar display demonstrated the feasibility of presenting timely warnings for areas in severe storm paths graphically. Mathematical derivations and three case studies utilizing operationally oriented software are presented with suggestions for future work. Further processing of the displayed data for rapid isolation and tracking of selected storms was computerized. Author

N77-21804# National Oceanic and Atmospheric Administration, Washington, D. C.
AVERAGE CIRCULATION IN THE TROPOSPHERE OVER THE TROPICS, JANUARY 1968 - AUGUST 1972
Thomas I. Gray, Jr., Joseph R. Irwin, Arthur F. Krueger, and Marylin S. Varnadore Jul. 1976 470 p refs
Avail: SOD HC $4.40

Charts of time-averaged circulation of the middle and upper troposphere over the tropics are presented. Theses analyses are based on daily operational products which use expanded and improved data. The analyses show existence of circulation features which were poorly described previously. Interhemispheric flow and variations in the vertical wind structure are examined. The zonal and meridional wind components, speeds, and standard deviations of these variables, as well as steadiness factor and stream function, are analyzed. Time averages from a 54-month record are computed for monthly, seasonal, and the annual mean periods. These data are processed for the 700-, 500-, 300-, 250-, and 200-mb levels. Author

N77-21805# Battelle Pacific Northwest Labs., Richland, Wash.
SOME EFFECTS OF ISENTROPIC VERTICAL MOTION SIMULATION IN A REGIONAL SCALE QUASI LAGRANGIAN AIR QUALITY MODEL
W. E. Davis and L. L. Wendell May 1976 5 p refs Presented at Symp. on Atmospheric Turbulence, Diffusion, and Air Quality, Raleigh, N. C., 19 Oct. 1976
(Contract E(45-1)-1830)
(BNWL-SA-5669; Conf-761003-12) Avail: NTIS HC A02/MF A01

After modifying the transport phase of the constant layer assessment model to include isentropic approximations and doing some preliminary testing, the isentropic method was found to be feasible. It was shown, in case studies, that in frontal storms large discrepancies between the isentropic and the constant layer models can occur in plume position estimates and in the subsequent location and occurrence of wet removal, both in-cloud and below-cloud. In a limited comparison, the model including isentropic considerations was shown to reasonably approximate trajectories on isentropic surfaces. ERA

N77-21806# Royal Netherlands Meteorological Inst., De Bilt.
TEMPERATURE AND WIND OBSERVATIONS AT HEIGHTS FROM 2 TO 200 m AT CABAUW IN 1973
A. P. VanUlden, J. G. VanderVliet, and J. Wieringa 1976 18 p refs
(KNMI-WR-76-7) Avail: NTIS HC A02/MF A01

The 215 m high meteorological mast in Cabauw, the Netherlands, is briefly described with respect to construction, instrumentation, and surroundings. Tables of checked half-hourly averages of temperature at 2, 9, 20, 40, 80, 120, 160, and 200 m height, and of wind speed and direction at 10, 80, and 200 m, are presented for whole of 1973, with information on the complete measurement program. Author (ESA)

N77-21807# Royal Netherlands Meteorological Inst., De Bilt.
LIMITS OF THE PERFORMANCE INDEX RELATED TO FORECASTS OF THE MONTHLY AVERAGE TEMPERATURE [GRENZEN AAN DE PRESTATIE-INDEX MET BETREKKING TOT VERWACHTINGEN VAN DE MAANDGEMIDDELDE TEMPERATUUR]
H. M. VandenDool and J. L. Nap 1976 7 p refs In DUTCH
(KNMI-V-277) Avail: NTIS HC A02/MF A01

An estimate is given of the performance index (PI), the climatological probability of a hit in forecasting the monthly average temperature, which normally lies between 0 and 0.10. The method used is a method of analogs, which produced a PI of 0.06 over the period February 1968 through December 1974. In addition, a PI was determined by a least effort method. ESA

N77-21808# World Meteorological Organization, Geneva (Switzerland).
THE MONSOON EXPERIMENT Global Atmospheric Research Program
Oct. 1976 154 p refs Prepared jointly with ICSU, Rome
(GARP-Publ-18) Avail: NTIS HC A08/MF A01; WMO, Geneva

Within the GARP framework, a monsoon sub-program, having at its center a monsoon experiment-MONEX, has been drawn up. The objectives of MONEX are outlined followed by a discussion of the scientific problems relating to summer and winter monsoons. The observational requirements and the observing system for MONEX are described together with the data management system. The oceanographic and numerical experimentation programs for the experiment are also reviewed. ESA

N77-21809# Royal Netherlands Meteorological Inst., De Bilt.
MARINE CLIMATOLOGICAL SUMMARIES FOR THE MEDITERRANEAN AND THE SOUTHERN INDIAN OCEAN, VOLUME 2, 1962
1976 498 p
(KNMI-151-2) Avail: NTIS HC A21/MF A01; Roy. Neth. Meteorol. Inst. DFI 25

Marine climatological summaries for 1962 of certain areas representative of the Mediterranean Sea, Southern Indian Ocean, and Australian Waters are presented. Observations include cloud amount; dry-bulb, dew-point, sea surface and air-sea temperatures; wind; pressure; visibility; and waves. ESA

N77-21810# Stockholm Univ. (Sweden). Inst. of Meteorology.
INITIALIZATION OF PRIMITIVE EQUATION MODELS. SOME ASPECTS OF INCLUDING A DIVERGENT WIND COMPONENT INTO THE INITIAL STATE
Harald Lejenaes 8 Oct. 1976 35 p refs
(DM-21) Avail: NTIS HC A03/MF A01

A primitive equation model is capable of describing not only the Rossby mode of the atmospheric motion but also the gravity-inertia mode. The problem of how to adjust mass and wind fields initially to minimize as much as possible the energy in the gravity mode was studied. Thereby data from one time level was used: a method called static initiliazation. A divergent wind component was derived from the quasi-geostrophic equations and was incorporated into an initial state adjusted using the balance equation. Forecasts were made to find out the impact on the gravity mode of this initialization technique. It was found that for forecasts up to 6 hours this technique is of some importance, but for longer forecasts it may be classified as being of little value. A sensitivity test, made by comparing the quasi-geostrophic divergence with the corresponding divergence obtained from a forecast employing a damping numerical scheme, reveals that the quasi-geostrophic divergence is too smooth to be able to better minimize the energy in the gravity mode.
Author (ESA)

N77-21811# Science Applications, Inc., McLean, Va.
SOLAR DATA VERIFICATION PROJECT Final Report
J. E. Cummings Sep. 1976 104 p refs Sponsored by Elec. Power Res. Inst.
(EPRI Proj. RP552)
(PB-260598/8; EPRI-ER-258) Avail: NTIS HC A06/MF A01 CSCL 04B

Meteorological parameters having primary influence upon solar energy systems are identified and classified. The requirements of the electric utility industry for solar data are derived. The currently available solar data resources are assessed and their deficiencies identified. Instruments and data acquisition devices are described, and monitoring station preliminary designs and cost data are presented. The data management functions required to translate raw data into information directly useful to the electric utility industry are defined. Recommendations for electric utility industry actions are made. GRA

N77-21812# National Environmental Satellite Service, Washington, D. C. Meteorological Satellite Lab.
ON THE ESTIMATION OF AREAL WINDSPEED DISTRIBUTION IN TROPICAL CYCLONES WITH THE USE OF SATELLITE DATA
Andrew Timchalk Aug. 1976 53 p refs
(PB-261971/6; NOAA-TR-NESS-74; NOAA-76100603) Avail: NTIS HC A04/MF A01 CSCL 04B

An attempt is made to determine whether the areal windspeed distributions in tropical cyclones can be estimated by use of two satellite data parameters: the low-level convective cloud band crossing angle relative to tangents to concentric circles centered on the eye, and the infrared temperatures from the 10.5-to-12.5 micrometer channel. These two parameters plus the ground truth winds were all derived for 128 polar coordinate grid points (16 azimuths and 8 radii). Coincident values of the variables were evaluated statistically first by linear regression and afterward by multiple screening regression. GRA

N77-21813# National Environmental Satellite Service, Washington, D. C.
ESTIMATION OF DAILY PRECIPITATION OVER CHINA AND THE USSR USING SATELLITE IMAGERY
Walton A. Follansbee Sep. 1976 37 p refs
(PB-261970/8; NOAA-TM-NESS-81; NOAA-76111034) Avail: NTIS HC A03/MF A01 CSCL 04B

The data consisted of NOAA-4 infrared imagery taken at approximately 9 a.m. and 8 p.m., local time, and visual pictures taken near 9 a.m., local time, all with one-half mile resolution. The major human input to the technique is identification of precipitating clouds in the infrared imagery, aided by inspection of the visual pictures. The technique consists of three steps: (1) delineating the area(s) covered by precipitating clouds in each of two consecutive infrared images taken at approximately 12-hour

intervals; and (2) using cloud motion models developed for the purpose, delineating the envelope of precipitation and isopleths of duration of precipitation in hours. GRA

N77-21814# Naval Electronics Lab. Center, San Diego, Calif.
EVALUATION OF A XONICS ACOUSTIC ECHOSOUNDER AND WIND-SENSOR SYSTEM
D. R. Jensen and J. H. Richter 26 Jul. 1976 36 p refs
(WR0330201)
(AD-A031974; NELC-TR-1997) Avail: NTIS HC A03/MF A01 CSCL 17/1

XONICS acoustic echosounder and wind-sensor system has the capability of simultaneously measuring temperature fluctuations in the lower atmosphere and the three wind components as a function of altitude. Reliable wind measurements are rarely obtainable. Author (GRA)

N77-21815# Air Force Geophysics Lab., Hanscom AFB, Mass.
THE USE OF DIGITAL RADAR IN SHORT-RANGE FORECASTING
H. Stuart Muench and William E. Lamkin 4 Aug. 1976 59 p refs
(AF Proj. 3628)
(AD-A033624; AFGL-TR-76-0173; AFGL-AFSG-348) Avail: NTIS HC A04/MF A01 CSCL 17/9

As part of a program to improve short-range forecasts of weather conditions at aircraft terminals, a digital radar system was established at Air Force Geophysics Laboratory, Bedford Mass. The system, consisting of AN/FPS-77, digital interface, microwave transmitter-receiver, video integrator and computer, was installed in late 1972. Since that time the system has been used in conjunction with a network of 26 automated weather stations to make experimental forecasts of visibility and severe-weather conditions. The radar output of digital maps of radar intensity was found to be very convenient, but the inability of the radar to detect small water droplets limits the use in low visibility forecasting primarily to heavy rain storms and snow storms. In severe storms modest success was attained forecasting gusts, using digital maps. The large amounts of weather information from the network and radar frequently saturated the forecaster making forecasts at 15-min intervals, and relief was sought in the form of objective aids. Preliminary relationships between radar intensity, extinction coefficient (visibility) and rainfall rate have been formulated. In addition, a technique was developed using digital radar maps to obtain motion vectors and make probability forecasts of severe weather conditions. The calibration procedure relies on intensity of ground targets (hills and towers) for day-to-day relative calibration, and absolute calibration has been limited to Z-R relations. Author (GRA)

N77-21816# National Oceanic and Atmospheric Administration, Asheville, N. C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 12, NO. 3. QUARTERLY ISSUE JULY-AUGUST-SEPTEMBER 1975
1976 501 p
(PB-261986/4; NOAA-76111016) Avail: NTIS MF A01; HC Avail: National Climatic Center, Federal Bldg., Asheville, N. C. 28801. Attn: Publications CSCL 04B

Each metrocket report includes measured wind and/or temperature and computed values of pressure, density, speed of sound, and fall velocity for significant levels, constant pressure levels, and interpolated 1 kilometer intervals. Also included is a corawinsonde report used primarily to provide a base level for computing the metrocket thermodynamic data. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N77-21817*# Environmental Research and Technology, Inc., Concord, Mass.
ESTIMATION OF THE GEOPHYSICAL PROPERTIES OF THE OCEAN SURFACE USING AIRCRAFT MICROWAVE MEASUREMENTS Final Report, Aug. 1974 - Aug. 1976
Mary Grace Fowler, James H. Willand, David T. Chang, and Ronald G. Isaacs Feb. 1977 66 p refs
(Contract NAS5-20619)
(NASA-CR-152479; P-1143F) Avail: NTIS HC A04/MF A01 CSCL 08C

An improved model of the effects of sea state on microwave signature has been developed which incorporates the different effects of whitecaps and streaks to define the response of microwave channels to wind speed. This model has been demonstrated to agree with recent measurements. An approximation model has also been incorporated to describe the effects of precipitation on microwave radiation through a computationally rapid routine. The use of these models and a new technique to allow the selection of the most climatologically appropriate D-matrix is demonstrated in the inversion of data collected over the bering Sea. Surface wind speed agrees very well with observations while good results are obtained for integrated water vapor, and liquid water. Author

N77-21818*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A REVIEW OF APPLICATIONS OF MICROWAVE RADIOMETRY TO OCEANOGRAPHY
Thomas T. Wilheit, Jr. Feb. 1977 22 p refs Submitted for publication
(NASA-TM-X-71296; X-953-77-27) Avail: NTIS HC A02/MF A01 CSCL 08C

The emissivity of sea ice and atmospheric precipitation was investigated. Using the above physics, the data from the Electrically Scanning Microwave Radiometers (ESMR's) on the Nimbus-5 and Nimbus-6 satellites operating at wavelengths of 1.55 cm and 8mm, respectively, can be interpreted in terms of rain rate, ice coverage, and first year versus multi-year ice determination. The rain rate data is being used to establish a climatology of rainfall over the oceans. Both ice and rain data sets have been generated for the Global Atmospheric Research Project Data Systems Test. Author

N77-21819# Massachusetts Inst. of Tech., Cambridge. Sea Grant Project Office.
THE UNITED STATES AND THE OCEANS: OPPORTUNITIES FOR INDEPENDENCE
Alfred A. H. Keil Sep. 1976 41 p refs Presented at Ann. Sea Grant Lecture and Symp., 5th, Cambridge, Mass., 23 Sep. 1976 Sponsored in part by NOAA
(PB-261991/4; MITSG-77-1; NOAA-76111001) Avail: NTIS HC A03/MF A01 CSCL 05C

The main thoughts were that the key to systematic and coherent development of United States Ocean activities is an integrated ocean policy, which can provide the framework for individual marine actions. Such a policy must envision domestic ocean utilization in the context both of international ocean developments, and the attitude of many countries that ocean resources are 'the common heritage of mankind.' Such a policy must envision the United States' position toward the oceans within the broader framework of our country's aspirations in a changing world. GRA

N77-21820# Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
TRANSVERSE CIRCULATION AND MASS TRANSPORT IN ESTUARIES Final Report
Yu-Hwa Wang Oct. 1976 97 p refs
(Grant NSF GK-42124)
(PB-261114/3; TR-034) Avail: NTIS HC A05/MF A01 CSCL 08J

A stably stratified flow field with longitudinal and transverse circulation was created in a newly designed and constructed circular plexiglass basin. Two cases are being investigated; water and brine streams are introduced to the circular basin from the same distribution, and the opposite direction. Comparison between these longitudinal and transverse components are made. The occurrence of these large scale motions is considered to be related to the sudden expansion of river and tidal flows in the estuary and the estuarial boundaries. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N77-21821*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLANETARY QUARANTINE Semiannual Review, 1 Jan. - 30 Sep. 1976
7 Jan. 1977 211 p refs
(Contract NAS7-100)
(NASA-CR-152648; JPL-900-762) Avail: NTIS HC A10/MF A01 CSCL 06M

Those areas of future missions which will be impacted by planetary quarantine (PQ) constraints were identified. The specific objectives for this reporting period were (1) to perform an analysis of the effects of PQ on an outer planet atmospheric probe, and (2) to prepare a quantitative illustration of spacecraft microbial reduction resulting from exposure to space environments. The Jupiter Orbiter Probe mission was used as a model for both of these efforts. Author

N77-21822*# San Francisco Univ., Calif. Dept. of Physics.
GROUND-BASED DOSIMETRY SUPPORT FOR EXPERIMENT AR002
R. Cassou and E. V. Benton [1976] 12 p
(Contract NAS9-14396)
(NASA-CR-151245; TR-43) Avail: NTIS HC A02/MF A01 CSCL 06R

Actinomyces levoris colonies were exposed to alpha particles at the 184-inch cyclotron, and Streptomyces levoris colonies were exposed to Ne-20 ions. A description is given of the experimental conditions for each experiment along with tables listing the doses delivered to the colonies. The doses for the Actinomyces levoris exposures came from calibrations made by the cyclotron operators, while the doses for the Streptomyces levoris exposures came in part from cave calibrations and also in part from calculations. Author

N77-21823# Martin Marietta Labs., Baltimore, Md.
MECHANISMS OF OXYGEN EVOLUTION
Richard Radmer and George Cheniae Aug. 1976 88 p refs Sponsored in part by Kentucky Univ. Agricultural Experiment Station Submitted for publication
(Contract E(11-1)-3326; Grants NSF PCM-76-02536; NSF PCM-74-20736-A01; NSF AER-73-03291)
(COO-3326-49) Avail: NTIS HC A05/MF A01

The production of O2 from water requires the collaboration of four oxidizing equivalents. When dark-adapted O2 evolving photosynthetic material is illuminated by a sequence of short saturating flashes, the amount of O2 evolved per flash oscillates with a period of four. This indicates that a charge-collector, operating with its own reaction center, successively collects and stores four oxidizing equivalents, which are used in a concerted oxidation of two water molecules. Luminescence, fluorescence, and pH changes also reflect this cycle of four. The O2 precursor states are quite stable; under some conditions, they can have a lifetime of several minutes. The O2 yielding reactions and reactions associated with trap recovery are fast relative to the rate-limiting step of photosynthesis. ERA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N77-21824# Civil Aeromedical Inst., Oklahoma City, Okla.
STRESS IN AIR TRAFFIC CONTROLLERS: EFFECTS OF ARTS-3
C. E. Melton, R. C. Smith, J. M. McKenzie, S. M. Hoffman, and J. T. Saldivar Nov. 1976 10 p refs
(AD-A034752/6; FAA-AM-76-13) Avail: NTIS HC A02/MF A01 CSCL 01/2

Physiological, biochemical, and psychological assessments of stress in air traffic controllers were made at Los Angeles (LAX) and Oakland (OAK) Terminal Radar Approach Control (TRACON) facilities before and after installation of Automated Radar Terminal Systems-III (ARTS-III). Heart rates of controllers on duty or at rest scarcely changed from before to after ARTS-III installation. Total stress increased at both TRACONs, and the increase was entirely due to elevated catecholamine excretion. Steroid excretion was significantly reduced at both facilities after ARTS-III installation. Scores on the A-State scale of the State-Trait Anxiety Inventory indicated that introduction of ARTS-III had no appreciable effect on work-related anxiety levels of controllers. The post-ARTS-III A-State means for both facilities were not significantly elevated. A-Trait was unchanged at LAX but decreased significantly at OAK. Assessments of A-State showed significant work-related increments but tended to be low. There were no correlations between anxiety and physiological data. Author

N77-21825*# Scientific Translation Service, Santa Barbara, Calif.
APPLICATION OF DECISION THEORY TO THERAPEUTIC TESTS, AN EXTENSION OF THE MODEL OF COLTON
C. Oudin and J. Lellouch Washington NASA Apr. 1977 13 p refs Transl. into ENGLISH from Rev. Statistique Appl. (France), v. 23, 1975 p 35-41
(Contract NAS7-100)
(NASA-TT-F-16775) Avail: NTIS HC A02/MF A01 CSCL 06E

The therapeutic test was considered as a decision problem: how to maximize utility, rather than a test problem and is there a significant difference between treatments. Assuming that two possible treatments are available and that a group of patients needs to be treated in the best way, the question was discussed as to how to modify the procedure and obtain the results. Author

N77-21826*# Harvard Medical School, Boston, Mass.
THE CONTROL OF CALCIUM METABOLISM BY PARATHYROID HORMONE, CALCITONIN AND VITAMIN D Final Progress Report, 1 Aug. 1975 - 31 Dec. 1975
John T. Potts, Jr. 31 Dec. 1976 31 p refs
(Contract NAS9-11011)
(NASA-CR-151325) Avail: NTIS HC A03/MF A01 CSCL 06P

Advances in analysis of chemistry and physiology of parathyroid hormone, calcitonin, and Vitamin D are described along with development of techniques in radioassay methods. Emphasis is placed on assessment of normal and abnormal patterns of secretion of these hormones in specific relation to the physiological adaptations of weightlessness and space flight. Related diseases that involve perturbations in normal skeletal and calcium homeostasis are also considered. Author

N77-21827# American Museum of Natural History, New York.
SPACE AGE RESEARCH AND MEDICINE: A STUDY OF DYNAMIC MAN IN HIS ENVIRONMENT
Ralph Rohweder, comp. [1977] 45 p refs
Avail: NTIS HC A03/MF A01

Medical research for manned space flight considers the following topics: gravity, hypothermia, body rhythms, exobiology, bioinstrumentation and telemetry, and environmental management. G.G.

N77-21828# Battelle Pacific Northwest Labs., Richland, Wash.
PROBABILISTIC APPROACH TO EXTERNAL CLOUD DOSE CALCULATIONS USING ONSITE METEOROLOGICAL DATA
D. L. Strenge, E. C. Watson, T. J. Bander, and W. E. Kennedy 1976 10 p refs Presented at the Health Physics Soc. Ann. Meeting, San Francisco, 29 Jun. - 2 Jul. 1976
(Contract E(45-1)-1830)
(BNWL-SA-5816; Conf-760652-3) Avail: NTIS HC A02/MF A01

A method is described for calculation of external total body and skin doses from accidental atmospheric releases of radionuclides based on hourly onsite meteorological data. The method involves calculation of dose values from a finite size cloud for each hourly observation for a given radionuclide inventory. These values are then used to determine the probability of occurrence of dose levels for specified release times ranging from one hour to 30 days. ERA

N77-21829# Interuniversitair Reactor Instituut, Delft (Netherlands).
COPPER METABOLISM (COMPARED TO ZINC METABOLISM) [KOPERSTOFWISSELING (EN ZINKSTOFWISSELING IN VERGELIJKING HIERMEE)]
C. J. A. VandenHamer 1976 17 p refs In DUTCH Presented at the 12th Refreshment Course for Internists, Utrecht, 13 May 1976
(IRI-133-76-07) Avail: NTIS HC A02/MF A01

The role of copper as a trace element in human metabolism was analyzed and compared to that of zinc. The function of Cu in the organism and in clinical chemistry is discussed. Effects of Cu on the liver function are underlined. Other aspects such as Cu distribution during childhood, toxicity, deficiency of Cu and Zn, and genetical defects of Cu metabolism are mentioned. ESA

N77-21830# Interuniversitair Reactor Instituut, Delft (Netherlands).
OVARY DOSES RESULTING FROM THREE X-RAY DIAGNOSES [OVARIUMDOSIS TENGEVOLGE VAN EEN DRIETAL DIAGNOSTISCHE ROENTGENVERRICHTINGEN]
A. VantRiet Mar. 1976 41 p refs In DUTCH Supplement to IRI-190-75-05: See N76-19801 Sponsored by Min. of Public Health and Hygiene
(IRI-190-76-01; IRI-190-75-05-Suppl) Avail: NTIS HC A03/MF A01

An investigation on the ovary doses of patients irradiated with X-rays for intravenous pyelography, pelvis or belly tests was made. Some 200 skin dosos measurements were made in nine hospitals in the Netherlands. Using data from the literature and phantom measurements the ovary doses were estimated. Results show an appreciable spread, not only between data from different hospitals, but also in the doses per photograph taken in the same hospital which can only partly be explained by the difference in thickness of the patients. ESA

N77-21831# Nederlands Instituut voor Praeventieve Geneeskunde TNO, Leiden.
A SYSTEM THEORETICAL ANALYSIS OF BLOOD PRESSURE REGULATION IN HUMANS [EEN SYSTEEMTHEORETISCHE ANALYSE VAN DE BLOEDDRUKREGELING BIJ DE MENS]
P. M. F. Oomen and M. Woerlee Jun. 1975 102 p refs In DUTCH
Avail: NTIS HC A06/MF A01

A survey of the literature is presented, and a discussion on the steady state level of blood pressure is given. The kidney and the schematic kidney models of Guyton are discussed, leading to a new, slightly changed, kidney model. Computer simulation tests of the new model, using the FELK (Guyton's circulation program) and FKOR (new circulation program), are presented and discussed. ESA

N77-21832# Medical Biological Lab. RVO-TNO, The Hague (Netherlands).
TOXIC PROPERTIES OF CN AND CS [TOXISCHE ELGENSCHAPPEN VAN CN EN CS]
D. M. W. Elskamp 1976 19 p refs In DUTCH
(MBL-1976-14; TDCK-68717) Avail: NTIS HC A02/MF A01

Toxic properties of the lacrimating gases CN (alpha-cloroacetophenone) and CS (O-chlorobenzylidenemalonitrile) were compared. The pharmacology of CN and CS is discussed and toxic effects, resulting from animal tests and from chemical data, are dealt with. Toxicity data from animal tests are presented and these data are extrapolated to humans. It is concluded that the mechanism of action of CS is very well known, that of CN is not; there is no indication for carcinogenic action of both; CN acts embryotoxic, CS does not; both are sensitizing; 5 mortal cases are known for CN, for CS none; CS does not cause permanent damage to eyes, respiratory system or skin; CS has a lower effective dosage, a higher lethal dosage, and a larger safety margin than CN. ESA

N77-21833# Medical Biological Lab. RVO-TNO, The Hague (Netherlands).
THE CAUSE OF DEATH RESULTING FROM TRANSFUSION RESISTANT SHOCK. PART 2: POTASSIUM INTOXICATION AS A POSSIBLE CAUSE OF DEATH
M. Wijnans, P. W. Valkenburg, J. A. Luthjens-Neijhoff, and P. vanEck Apr. 1976 43 p refs In DUTCH; ENGLISH summary
(MBL-1976-5; TDCK-67751) Avail: NTIS HC A03/MF A01

Potassium intoxication as a possible cause of death in irreversible shock was investigated in rats. It was found that in irreversible hemorrhagic shock provoked by bleeding rats from a common iliac artery, the plasma-K gradually rises to reach a value of about 10 mmol/l just before death. This increase in plasma-K parallels the progressive decrease in blood pressure. If a form of hemorrhagic shock is used in which, by occlusion of one or both carotid arteries, death is caused by brain edema, the rise in plasma-K is less marked. On using a sublethal shocking procedure, the plasma-K remained practically unaltered. ESA

N77-21834# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
THE INFLUENCE OF ENVIRONMENTAL FACTORS ON TASK LOAD AND DRIVING BEHAVIOR. A PRELIMINARY INVESTIGATION [DE INVLOED VAN OMGEVINGSFAKTOREN OP MATEN VOOR TAAKBELASTING EN RIJGEDRAG - EEN VERKENNEND ONDERZOEK]
P. W. Biesta and G. J. Blaauw 1976 68 p refs In DUTCH; ENGLISH summary
(IZF-1976-7; TDCK-67928) Avail: NTIS HC A04/MF A01

The influence of some static and dynamic factors in the environment on heart rate, heart rate variation, and driving behavior was studied. Subjects drove an instrumented car on three different test routes: town, four-lane motorway with divided traffic lanes, and two-lane highway. Also, subjects drove under two different order conditions. An auditory subsidiary task was used to obtain more information on driving task difficulty. All heart rate measures proved to be sufficiently sensitive to differentiate between driving in town versus driving on the motorway or the highway; static aspects of the environment, such as narrow lane width, showed an effect on heart rate variability. The auditory subsidiary task had an influence on the number of reversals in heart rate and steering signal. Also, there existed some remarkable differences in lateral and longitudinal control between motorway and highway. Author (ESA)

N77-21835# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
ADVICE ON AUTOMATION OF PERIMETRY INVESTIGATION IN THE ARMED FORCES
J. J. Vos 1976 41 p refs In DUTCH; ENGLISH summary
(Contract A71/K/112)
(IZF-1976-19; TDCK-68682) Avail: NTIS HC A03/MF A01

A method of perimetry investigation in which multiple stimulus generation is produced via a cathode ray tube is described. By suitable use of technical features, the apparatus can be adapted to apply to perimetry without attendance of auxiliary personnel for each patient. The electronic design enables the apparatus to be computer controlled; with a number of display units connected to one central processor, a remunerative perimetric center seems to come within the reach of possibilities. The present development is not, however, far enough evolved to consider it a suitable technique for military screening. As competing developments also have not reached that stage yet, it is advised that, for the present, the Armed Forces abandon the idea of automatic perimetry. Author (ESA)

N77-21836# Medical Biological Lab. RVO-TNO, The Hague (Netherlands).
A BONESCREW FOR INTRASTERNAL INFUSIONS [EEN BOTSCHROEF VOOR HET GEVEN VAN INTRA-STERNALE INFUSIES]
H. F. Dankmeijer and M. Wijnans Jul. 1976 42 p refs In DUTCH
(Contract A69/KL/039)
(MBL-1976-9; TDCK-67960) Avail: NTIS HC A03/MF A01

Investigations on the development of a bonescrew for the administering of infusions to seriously wounded persons are described. The construction of the screw, its efficiency on dead persons, and clinical investigations on a large number of patients are dealt with. The risk of complications is indicated, the possibility for application in bones other than the sternum is discussed, and the procedure for applying the screw for infusion via the sternum is given. ESA

N77-21837# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
EPICARDIAL POTENTIALS DERIVED FROM SKIN POTENTIAL MEASUREMENTS
A. H. Damen Jul. 1976 26 p refs
(TH-76-E-64; ISBN-90-6144-064-5) Avail: NTIS HC A03/MF A01

The transformation of torso-skin potentials into an instructive form to provide direct insight into the depolarization wave through the ventricle walls is dealt with. Several intuitive and not yet mathematically defined criteria were used to obtain an upper limit for the order of an equivalent set of multipoles, which is observable from skin potentials. ESA

N77-21838# Office of Naval Research, Arlington, Va.
NAVY-WIDE WORKSHOP ON HIGH PRESSURE BIOMEDICAL RESEARCH Final Report
1976 63 p Proc. of Workshop held at Panama City, Fla., 9-11 Mar. 1976 Prepared in cooperation with Naval Med. Res. and Develop. Command
(AD-A031993; ONR-ACR-218) Avail: NTIS HC A04/MF A01 CSCL 06/19

The report represents a summary of scientific and operational matters relating to improving man's ability to work underwater. The bulk of the report is centered about eight relevant discussion panel sessions: Physiological criteria for equipment design; Cold protection; Performance; Decompression; Decompression Sickness; Oxygen Toxicity; HPNS and Narcosis; and Future Trends. Author (GRA)

N77-21839# Mount Sinai Medical and Graduate Schools, New York. Dept. of Pediatrics.
DEVELOPMENT AND CLINICAL EVALUATION OF BLOOD GAS SENSORS FOR CONTINUOUS MONITORING (ADULT AND NEONATE) Annual Report, May 1975 - May 1976
Edwin G. Brown Jun. 1976 68 p refs
(Contract HR-5-2949)
(PB-258798/8; NIH-N01-HR-52949) Avail: NTIS HC A04/MF A01 CSCL 06L

A catheter electrode for continuously monitoring oxygen tension in the blood has been developed, and in vitro and in vivo (animal) testing is nearly completed. The design of the sensor is simple and permits a completely unobstructed catheter lumen. It can be manufactured in large quantities relatively inexpensively. Eighty-six percent of all the catheter sensors undergoing a careful pre-test evaluation for flaws performed remarkably well. GRA

N77-21840# Union Carbide Corp., Bound Brook, N.J. Research and Development Dept.
THE BIOLOGICAL EVALUATION OF POLY (VINYL ACETATE-CO-CROTONIC ACID) IONOMER HYDROGEL COATINGS
G. T. Kwiatkowski, E. O. Lundell, and D. D. Stewart 9 Aug. 1976 12 p refs
(Contract HV-4-2950)
(PB-260669/7; NIH-NOI-HV-4-2950) Avail: NTIS HC A02/MF A01 CSCL 06L

Early in the ionomer biomaterials program attention was focused on the synthesis of polyelectrolytes and the identification of factors controlling their blood compatibility. Poly(vinyl acetate-co-2 percent crotonic acid) sodium ionomer was identified as a highly promising ionomer hydrogel, and a practical technique for covalently bonding this hydrogel to polyolefin substrates was developed. To advance this specific system to a clinical stage, a broad range of biological, toxicological and mechanical/physical data is being compiled. Radiation graft coated ionomer test specimens were supplied for renal embolus ring studies, platelet adhesion studies, protein absorption studies, hemolysis studies and flow erosion studies. GRA

N77-21841# Naval Postgraduate School, Monterey, Calif.
SOURCES AND BIOLOGICAL EFFECTS OF NONIONIZING ELECTROMAGNETIC RADIATION M.S. Thesis
Andrew Peter Sosnicky Sep. 1976 75 p refs
(AD-A032367) Avail: NTIS HC A04/MF A01 CSCL 20/3

This thesis is designed to provide an insight into potential biological effects on humans resulting from exposure to nonionizing electromagnetic radiation emitted by communications and radar equipment. The spectrum considered extends from the extremely low frequency band, which may be employed for communicating with submerged submarines, through the microwave band, which is utilized for satellite communications and radars. The different views of the Soviet bloc and the Western nations are presented. A near term safety measure, the use of protective garments, is recommended while debate continues. The underlying intent of this thesis is to provide a compact document which can be used to introduce telecommunications managers and other interested personnel to the uses, characteristics, and possible hazards of this valuable portion of the electromagnetic spectrum Author (GRA)

N77-21842# Bureau of Radiological Health, Rockville, Md.
THE BIOLOGICAL EFFECTS OF IONIZING RADIATION: AN OVERVIEW Final Report
Mark H. Barnett Oct. 1976 26 p refs
(PB-262453/4; DHEW/PUBL/FDA-77/8004;
FDA/BRH-77/16) Avail: NTIS HC A03/MF A01 CSCL 06R

The manual on the biological effects of ionizing radiation is an overview of the biological effects of ionizing radiation, including: basic mechanisms of radiation injury; determinants in radiation damage; short-term effects; and long-term somatic genetic effects, including a summary of human epidemiological studies. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N77-21843# University of Southern Calif., Los Angeles. Behavioral Technology Labs.
THE EFFECTS OF INTERACTIVE GRAPHICS ANALOGIES ON RECALL OF CONCEPTS IN SCIENCE Technical Report, 1 Jan. - 1 Dec. 1976
Joseph W. Rigney and Kathy A. Lutz Aug. 1976 70 p refs
(Contract N00014-75-C-0838; ARPA Order 2284; NR Proj. 154-355; RR0420601)
(AD-A031928; TR-79) Avail: NTIS HC A04/MF A01 CSCL 05/9

In this series of three studies, interactive graphics, using the plasma panel, touch panel interface of the PLATO system, were used to simulate the topography and functions of a battery, to teach elementary concepts in electrochemistry. The effects of these graphics were compared with verbal descriptions of the topography and functions in otherwise equivalent lessons; and with playing checkers for the same amount of time as used by postlesson conditions requiring subjects to reconstruct the graphic simulation from memory, or to attempt to imagine mental images of these graphics. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N77-21844* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EMERGENCY DESCENT DEVICE Patent
Robert R. Belew, inventor (to NASA) Issued 19 Apr. 1977 7 p Filed 16 Oct. 1975 Supersedes N76-13770 (14 - 04, p 0493)
(NASA-Case-MFS-23074-1; US-Patent-4,018,423;
US-Patent-Appl-SN-623188; US-Patent-Class-254-158;
US-Patent-Class-188-291) Avail: US Patent Office CSCL 13L

A descent device is provided for emergency descent from tall structures and for lowering objects from high elevations, such as a hovering helicopter. The device includes a rotating spool having a cable wound thereon for descent and a rotation-retarding vane member which rotates in a fluid cylinder. An

adjustable bypass is provided for the fluid as the vane member rotates therein so that the speed of descent can be adjustably controlled. Official Gazette of the U.S. Patent Office

N77-21845*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Biotechnology Organization.
DEVELOPMENT AND TESTING OF A WET OXIDATION WASTE PROCESSING SYSTEM
Arthur L. Weitzmann 31 Mar. 1977 102 p refs
(Contract NAS9-13824)
(NASA-CR-151324) Avail: NTIS HC A06/MF A01 CSCL 06K

The wet oxidation process is considered as a potential treatment method for wastes aboard manned spacecraft for these reasons: (1) Fecal and urine wastes are processed to sterile water and CO2 gas. However, the water requires post-treatment to remove salts and odor; (2) the residual ash is negligible in quantity, sterile and easily collected; and (3) the product CO2 gas can be processed through a reduction step to aid in material balance if needed. Reaction of waste materials with oxygen at elevated temperature and pressure also produces some nitrous oxide, as well as trace amounts of a few other gases. Author

N77-21846# Rockwell International Corp., Anaheim, Calif. Metrology Lab.
A LABORATORY TEST TO MEASURE THEODOLITE OPERATOR BIAS
K. J. Lund 1976 31 p Presented at 6th Ann. Meas. Sci. Conf. at Cal-Poly, San Luis Obispo, Calif., 4 Dec. 1976
(X76-1516/101) Avail: NTIS HC A03/MF A01

A study was conducted to determine if significant individual biases exist in the angular measurements of theodolite operators performing astronomic azimuth determinations. A laboratory test was set up using two different types of theodolites to measure the angle between a simulated star and a mirror. Five different operators made several series of measurements with each of the instruments. A limited statistical analysis of the test results yielded several important conclusions about instrument and operator related phenomena. Observations related to operator vision and experience were also made, and a written examination was conducted to determine individual techniques and preferences in observing methods. Author

N77-21847*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PORTABLE BREATHING SYSTEM Patent Application
John S. Lovell, inventor (to NASA) (Hamilton Standard, Hartford) Filed 24 Mar. 1977 24 p
(Contract NAS9-14458)
(NASA-Case-MSC-16182-1; US-Patent-Appl-SN-780930) Avail: NTIS HC A02/MF A01 CSCL 06K

A semiclosed-loop rebreathing system is provided for use in a hostile environment. The system is characterized by a packed bed regenerative heat exchanger providing two distinct temperature-humidity zones of breathing gas with one zone providing cool, relatively dry air and the second zone providing hot, moist air. Exhaled gas is passed through the packed bed regenerative heat exchanger to increase the temperature and humidity of the gas and is then passed through a sorbent canister containing a lithium hydroxide bed to remove carbon dioxide. The carbon dioxide-free gas is then passed through the regenerative heat exchanger in the reverse direction to cool and dehumidify the gas to normal breathing conditions. NASA

N77-21848# School of Aerospace Medicine, Brooks AFB, Tex.
EVALUATION OF THE RAF P/Q OXYGEN MASK WITH THE USAF HGU-2A/P FLYING HELMET Final Report, 1 Nov. 1975 - 30 Apr. 1976
Roger L. Stork and Julian P. Cooke Sep. 1976 16 p
(AD-A032393; SAM-TR-76-32) Avail: NTIS HC A02/MF A01 CSCL 06/11

The RAF P/Q oxygen mask was evaluated for use in conjunction with the USAF flying HELMET. The mask/helmet assembly was tested for comfort, fit, fixed visual fields, and retention during sustained positive acceleration. The mask itself was tested for inspiratory resistance, ease of Valsalva, skin irritation, freeze resistance, and faceseal air leaks. Comparisons were then made with the MBU-5/P mask now operational in the U.S. Air Force. GRA

N77-21849# Wisconsin Univ., Madison. Dept. of Industrial Engineering.
DYNAMICS OF THE EYE AND HEAD WHEN SWITCHING VISUAL ATTENTION BETWEEN TWO TASKS
Gordon H. Robinson and Frank J. Rath 1 Oct. 1976 55 p refs
(Contract N00014-75-C-0364)
(AD-A031825; TR-76-18) Avail: NTIS HC A04/MF A01 CSCL 06/16

Subjects were required, on command, to shift their attention from an ongoing manual control task to a peripheral monitor displaying digital information for a discrete processing task. Measurements were made of eye and head dynamics during the visual search and processing tasks. The independent variables of monitor angle, monitor discriminability, certainty of monitor location, processing task complexity and the subjects' tracking task performance status at the time of the visual search command were examined for possible effects on the visual search patterns. Dependent performance measures included the reaction times of the eye and head, the time to acquire the monitor and the pattern of saccadic eye movements during this period, the time of fixation on the monitor, the time required for the processing task, and the time to reacquire the control task. GRA

N77-21850# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
USAF PILOT PROFICIENCY: AN ANALYSIS OF ACTUAL AND SIMULATED FLIGHT DATA M.S. Thesis
James T. Anderson and John F. Phillips Sep. 1976 94 p refs
(AD-A032296; SLSR-20-76B) Avail: NTIS HC A05/MF A01 CSCL 05/9

The purpose of this study was to determine whether USAF pilot proficiency has been reduced since the implementation of energy conservation measures (1972). These conservation measures resulted in reduced actual flying and the increased use of flight simulators. A census of total flight hours, aircraft accidents, and simulator usage data was analyzed for a defined population of pilots using direct comparison, analysis of variance, and regression analysis techniques. Pilot improficiency (inverse of proficiency) was defined as the average cost per aircraft accident per given period of time. This cost was used to quantify pilot proficiency, and a prediction model was formulated to determine its level when given flight and simulator hour variables. Other variables, such as phase of flight, aircraft type, pilot-in-command/instructor pilot time, and major command assignment were examined in the tests of the research hypotheses. The conclusions given the data of the study are: (1) There has been a decrease in total flying proficiency, and (2) The decrease in proficiency can be attributed to reductions in actual flight hours and to increases in the use of flight simulators as a substitute for actual flight. Author (GRA)

N77-21851# National Highway Traffic Safety Administration, Washington, D. C. Technical Services Div.
RESTRAINT SYSTEMS Subject Bibliography
Lois Flynn, comp. Apr. 1976 131 p refs
(PB-261119/2; DOT-HS-801-932; SB-04) Avail: NTIS HC A07/MF A01 CSCL 13F

A bibliography of literature acquired since the establishment of the National Highway Traffic Safety Administration (NHTSA) in 1967, as related to restraint systems in motor vehicles, is presented. It is comprised of NHTSA contract reports, reports of other organizations concerned with highway safety, and articles from periodicals in related fields. Citations follow the format used in the monthly abstract journal Highway Safety Literature and are indexed by a key-word-out-of-context (KWOC) listing, author, corporate author, contract number, and report number. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N77-21852*# Kanner (Leo) Associates, Redwood City, Calif.
SCHOOL-SEMINAR ON CETI PROGRAM (PARTICIPANTS REPORT)
Ya. Kukharenko Washington NASA Mar. 1977 9 p Transl. into ENGLISH from Znaniye-Sila (USSR), no. 4, 1976 p 28
(Contract NASw-2790)
(NASA-TT-F-17403) Avail: NTIS HC A02/MF A01 CSCL 03B

Methods for the discovery of planets around the nearest stars, for the detection of amino acids in the lunar soil, and for detection of relatively complex organic molecules in cosmic clouds were discussed. Concrete CETI (Communication with Extraterrestrial Intelligence) projects, and a formal definition of an intelligent system were also studied. S.M.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N77-21853*# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
DEVELOPMENT OF A HIGH CAPACITY BUBBLE DOMAIN MEMORY ELEMENT AND RELATED EPITAXIAL GARNET MATERIALS FOR APPLICATION IN SPACECRAFT DATA RECORDERS. ITEM 1: DEVELOPMENT OF A HIGH CAPACITY MEMORY ELEMENT Final Report, 18 Feb. 1975 - 31 Oct. 1976
P. J. Besser Mar. 1977 146 p refs
(Contract NAS1-12981)
(NASA-CR-144983; C74-192B/501) Avail: NTIS HC A07/MF A01 CSCL 09B

Several versions of the 100K bit chip, which is configured as a single serial loop, were designed, fabricated and evaluated. Design and process modifications were introduced into each succeeding version to increase device performance and yield. At an intrinsic field rate of 150 KHz the final design operates from -10 C to +60 C with typical bias margins of 12 and 8 percent, respectively, for continuous operation. Asynchronous operation with first bit detection on start-up produces essentially the same margins over the temperature range. Cost projections made from fabrication yield runs on the 100K bit devices indicate that the memory element cost will be less than 10 millicents/bit in volume production. Author

N77-21854# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
CONTROL DESIGNS FOR THE MICROPROCESSOR/BUBBLE MEMORY INTERFACE
Ronald R. Norton 7 Jan. 1977 5 p Presented at IEEE Computer Soc. Conf., San Francisco, 1-3 Mar. 1977
(X77-18/201) Avail: NTIS HC A02/MF A01

Considerations in the design of a controller to interface a microcomputer to a bubble memory are discussed, and three specific examples using the Intel 8080 processor and the Rockwell POS/S bubble memory are presented. Author

N77-21855# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
DESIGN AND PERFORMANCE OF A 100K BYTE SERIAL BUBBLE RECORDER
John E. Ypma and Paul Swanson Jan. 1977 6 p Presented at Spring COMPSON 77, the 14th IEEE Computer Soc. Intern. Conf., San Francisco, 28 Feb. - 3 Mar. 1977
(X77-26/501) Avail: NTIS HC A02/MF A01

A 102,400 word by 8 bit bubble domain recorder is described. The physical and electrical specifications for this pre-production prototype are given. Detailed illustration of the method of packaging the eight bubble domain devices into a single magnetic structure is provided. Finally, the sequence of magnetic device testing from wafer level through finished unit is discussed. Margin data for a typical finished unit are given, illustrating both the type of tests which must be run to check out a bubble memory system and also the amount of margin to be expected. Author

N77-21856# California Univ., Livermore. Lawrence Livermore Lab.
ARCHITECTURAL CONSIDERATIONS FOR GENERAL PURPOSE MULTIPROCESSORS
Lawrence C. Widdoes, Jr. Sep. 1976 17 p refs Presented at 13th IEEE Computer Soc. Intern. Conf., Washington, D. C., 7 Sep. 1976
(Contracts W-7405-eng-48; N00014-76-F-0023)
(UCRL-78631; Conf-760933-2) Avail: NTIS HC A02/MF A01

The potential advantages of multiprocessors are reviewed. Examples are considered to demonstrate that low performance processors and low cost interconnection networks are not cost effective in a broad sense. Communication requirements for multiprocessor applications are decomposed into three basic modes, and requirements are derived for the interconnection network. The cost of the interconnection network is considered. ERA

N77-21857# California Univ., Livermore. Lawrence Livermore Lab.
OUTLOOK FOR DIGITAL COMPUTING AND ITS APPLICATIONS, 1976-1995
Hon Wah Chin, Harlan Lau, Thomas McWilliams, Andrew Weisberg, L. C. Widdoes, and Lowell Wood 20 Aug. 1976 55 p refs Presented at Naval Studies Board Meeting, Monterey, Calif., Aug. 1976
(Contracts W-7405-eng-48; N00014-76-F-0023)
(UCID-17266) Avail: NTIS HC A04/MF A01

The current status of digital computing technology and its applications are briefly reviewed. A surprise free scenario for predicting the advance of technology and its applications for the next two decades is developed, and employed to set lower bounds on the performance of digital computing systems and their potential applications. Progress pacing features are identified, and are seen to be primarily of hardware origin in the near term, and due to software limitations in the longer term. ERA

N77-21858# California Univ., Livermore. Lawrence Livermore Lab.
LIVERMORE TIME-SHARING SYSTEM. PART 4: LIBRARY FILES. CHAPTER 304: ORDERLIB SUBROUTINE LIBRARY
Edna Carpenter, comp., S. V. Solbeck, comp., and K. Dusenbury, comp. 22 Mar. 1976 439 p refs
(Contract W-7405-eng-48)
(LTSS-304-Ed-2-Pt-4) Avail: NTIS HC A19/MF A01

The routines in the ORDERLIB subroutine library, which is available to users of the CHAT compiler (an extended FORTRAN compiler) and/or the ORDER batch processing system on CDC 6600 and 7600 computers of the Livermore time sharing system, are described. These include mathematical, service, input/output, and graphics routines; calling sequences, usage, and entry points are discussed. Error messages are tabulated, together with their meanings and suggestions as to possible causes and solutions. ERA

N77-21859# Los Alamos Scientific Lab., N. Mex.
HIGH-SPEED MULTIPLE-CHANNEL ANALOG TO DIGITAL DATA ACQUISITION MODULE FOR MICROPROCESSOR SYSTEMS
C. Dwayne Ethridge 1976 18 p refs Presented at Nuclear Sci., Scintillation and Semiconductor Counter Symp., New Orleans,

20 Oct. 1976
(Contract W-7405-eng-36)
(LA-UR-76-994; Conf-761006-2) Avail: NTIS HC A02/MF A01

Intelligent data acquisition and instrumentation systems established by the incorporation of microprocessor technology require high-speed analog to digital conversion of multiple-channel input signals. Sophisticated data systems or subsystems are enabled by the microprocessor software flexibility to establish adaptive input data procedures. These adaptive procedures are enhanced by versatile interface circuitry which is software controlled. ERA

N77-21860# National Physical Lab., Teddington (England). Div. of Computer Science.
EARLY WORK ON COMPUTERS AT BLETCHLEY
I. J. Good Sep. 1976 19 p refs Sponsored by Computer Systems and Electron. Requirements Board
(NPL-Com-Sci-82) Avail: NTIS HC A02/MF A01

This paper, number 1 in a series of special lectures on 'The Pioneers of Computing,' is an historical biographical account of the work on electronic computers at the UK Government code and cypher school at Bletchley, Buckinghamshire, England during World War 2. ESA

N77-21861# Royal Signals and Radar Establishment, Christchurch (England).
REDUNDANCY AND RECOVERY IN THE HIVE VIRTUAL MACHINE
J. M. Taylor May 1976 30 p refs
(RSRE-76010; BR54783) Avail: NTIS HC A03/MF A01

The HIVE project is concerned with studying high level virtual machine architectures suitable for designing and implementing large, high-integrity transaction processing applications such as communication switching and database access systems. The main aim of the work is to develop a unified set of structural concepts and components in terms of which all the different and often conflicting design aspects of such systems can be coherently expressed. The approach followed has been to embody these ideas in the specification of a high integrity virtual machine, HIVE, and to implement HIVE and evaluate it experimentally by using it to implement test-bed applications systems. This work has involved considering not only the architecture of the overall run-time software during normal operation, but also various selective approaches to data protection, redundancy and recovery, and methods for easing the task of describing, generating, and integrating all the software of an application in an incremental, evolutionary way. This report is concerned primarily with the first two of these areas. It presents the main points of the HIVE system as it stands at present, with particular emphasis on the selective data redundancy and recovery aspects, and also discusses the rationale behind the main design principles of the system. Author (ESA)

N77-21862# Admiralty Underwater Weapons Establishment, Portland (England).
SUBROUTINES FOR ICL 1904/CIL PLOTTER
W. J. Butterworth London HMSO Jul. 1976 33 p refs
(AUWE-Publ-42003; BR54420) Avail: NTIS HC A03/MF A01

A package of subroutines is described for use on the ICL 1904S computer, to output characters on paper tape which can then be used to drive a CIL plotter via a tape reader. Their use in FORTRAN and ALGOL is demonstrated. A means is available of using the same tapes on plotters attached to PDP computers. Author (ESA)

N77-21863# Gaertner (W. W.) Research, Inc., Stamford, Conn.
ANALYSIS AND DESIGN OF REAL-TIME PROCESSING SYSTEM FOR SENSOR DATA AT AMOS Final Technical Report, 1 Mar. 1975 - 31 Mar 1976
W. W. Gaertner, M. P. Patel, S. S. Reddi, C. T. Retter, W. M. Schreyer, and I. M. Singh Aug. 1976 304 p
(Contract F30602-75-C-0180; ARPA Order 2646)
(AD-A031483; GRI-4047-FR-Ch-1/4;
RADC-TR-76-244-Ch-1/4) Avail: NTIS HC A14/MF A01 CSCL 17/5

This report deals with the design of a computer system for the real-time processing of high-resolution video, photometric, and long-wavelength infrared data. An analysis of the data rates, generated by the various sensors and the algorithms involved in the subsequent data analysis, indicates that the combined processing requirements are in the order of 100 MIPS (million instructions per second), and that up to 16 Mbytes of high-speed memory may be needed. This processing power cannot be achieved with a sequential computer, and a parallel-processor architecture was therefore developed to achieve the necessary throughput. It has a very attractive cost/performance ratio and appears to be useful in a number of other application areas such as radar, sonar, data-base search and update, mapping, solution of partial differential equations, and simultaneous linear equations. The conclusion is drawn that the G-471 is a computer system which, for the signal and image processing fields, provides a processing-power/cost ratio which is at least an order of magnitude higher than that of large-scale sequential scientific computers. It is well suited to handle the near-real time processing requirements at AMOS. Author (GRA)

N77-21864# Rensselaer Polytechnic Inst., Troy, N.Y. Computer Research Lab.
AUTOMATIC DATA PROCESSING TECHNIQUES FOR GRAPHIC-DATA DISPLAY GENERATION AND ANALYSIS Interim Technical Report, 1 Sep. 1975 - 31 Aug. 1976
Herbert Freeman 1976 31 p refs
(Grant AF-AFOSR-2937-76)
(AD-A033315; CRL-50; AFOSR-76-1221TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

This Interim Technical Report summarizes the research carried out under Grant AFOSR 76-2937 during the period 1 September 1975 - 31 August 1976. The research activities were concerned with three distinct problem areas: (1) the development of efficient algorithms and heuristic techniques for the reconstruction of three-dimensional scenes from multiple photographs; (2) the study of improved coding schemes for line-drawing data, especially topographic maps; and (3) the development of thoroughly tested computer programs for eliminating the hidden lines in perspective views of complex planar-faced and quadric-surface-face objects. The individual research areas are briefly described and abstracts of the publications issued during the reporting period are given. Author (GRA)

N77-21035*# Lockheed-California Co., Burbank.
THE APPLICATION OF DIGITAL COMPUTERS TO NEAR-REAL-TIME PROCESSING OF FLUTTER TEST DATA
S. R. Hurley *In* NASA. Langley Res. Center Flutter Testing Tech. 1976 p 377-394 refs (For primary document see N77-21022 12-01)
Avail: NTIS HC A21/MF A01 CSCL 09B

N77-21135*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COST REDUCTION POTENTIAL OF THE DSN DATA BASE
M. McKenzie *In its* The Deep Space Network 15 Apr. 1977 p 203-220 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N77-21865*# Houston Univ., Tex.
ON THE CONVERGENCE OF OPTIMAL LINEAR COMBINATION PROCEDURES
William Tally Jan. 1977 9 p refs
(Contract NAS9-15000)
(NASA-CR-151250; Rept-63) Avail: NTIS HC A02/MF A01 CSCL 09B

An algorithm for describing optimal linear combinations in the feature selection process is considered. Various proofs are presented. D.M.L.

N77-21866*# Aerospace Corp., El Segundo, Calif. Computer Directorate.

MEASUREMENT, ESTIMATION, AND PREDICTION OF SOFTWARE RELIABILITY
Herbert Hecht Jan. 1977 43 p refs
(Contract NAS1-14392)
(NASA-CR-145135) Avail: NTIS HC A03/MF A01 CSCL 09B

Quantitative indices of software reliability are defined, and application of three important indices is indicated: (1) reliability measurement, (2) reliability estimation, and (3) reliability prediction. State of the art techniques for each of these procedures are presented together with considerations of data acquisition. Failure classifications and other documentation for comprehensive software reliability evaluation are described. Author

N77-21867# Los Alamos Scientific Lab., N. Mex.
PDP-11 DEBUGGING TOOL
D. E. Tolmie and M. E. Gallegos Aug. 1976 29 p refs
(Contract W-7405-eng-36)
(LA-6492-MS) Avail: NTIS HC A03/MF A01

Debugging a PDP-11 System can be quite frustrating; programs like ODT are helpful, but they must be integrated into existing software. Also, ODT adds overhead to the system since it is interrupt-driven through software traps. This makes it dangerous to use in real-time systems. A stand-alone hardware device was developed that can be connected to a PDP-11 running any software package. It has most of the features of ODT plus some unique features. Since it operates in a real-time, on-line, dynamic mode, it does not affect any timing or add overhead to the system. Traps are not required to drive it, and it is continually available. Many of its features can also be software-driven or -interrogated. The PDP-11 debugging tool can display information, modify memory, generate interrupts, simulate non-existing hardware, stack and display data or address values, count accesses to an address, halt when address accessed, and display the Unibus signals-all in real time. ERA

N77-21868# Los Alamos Scientific Lab., N. Mex.
SOFTWARE FOR THE INTEL 8080 MICROPROCESSOR RESIDENT ON MACHINE M (0)
William M. Seifert Jul. 1976 27 p refs
(Contract W-7405-eng-36)
(LA-6440-MS) Avail: NTIS HC A03/MF A01

Access to the Intel 8080 software which resides in the library of Machine M (0) is described. File definitions, control statements, user options, and examples are included. All reference manuals required are cited. ERA

N77-21869# Bettis Atomic Power Lab., West Mifflin, Pa.
SPAR1: A SEMI-ANALYTIC POINT-KERNEL COMPUTER PROGRAM FOR SHIELDING
O. J. Wallace Jun. 1976 165 p refs
(Contract E(36-1)-GEN-14)
(NAPD-TM-1196) Avail: NTIS HC A08/MF A01

SPAR1 calculates exact gamma ray fluxes from uniform sources with the shapes of slabs, disks, lines, cylinders, truncated cones, toroids, and spheres. Gamma ray dose rates and energy absorption rates may also be obtained by including in the program input data gamma ray buildup factors expressed in Taylor exponential coefficient from. SPAR1 will calculate fast neutron dose rates and thermal neutron fluxes in those cases where the use of neutron removal cross sections is valid. All 3-D sources having curved surfaces may have both curved and slab shields intervening between the source and the detector point. The treatment of cylindrical volume sources allows the detector point to be arbitrarily located, and a finite cylindrical shield may be considered. A cylindrical surface source option is also included. In all cases, uniform source strength, laminar shield, and the validity of the point kernel are assumed. ERA

N77-21870# Logicon, Inc., Dayton, Ohio.
MANAGEMENT GUIDE TO AVIONICS SOFTWARE ACQUISITION. VOLUME 1: AN OVERVIEW OF SOFTWARE DEVELOPMENT AND MANAGEMENT Final Report, Jan. 1975 - May 1976
Jun. 1976 51 p refs 4 Vol.
(Contract F33657-76-C-0234; AF Proj. 2257)
(AD-A030591; R:RW-75002-1-Vol-1; ASD-TR-76-11-Vol-1)
Avail: NTIS HC A04/MF A01 CSCL 01/3

An Overview of Software Development and Management. This volume is a summary of the avionics software acquisition process, its major milestones and decision points, and the terminology most frequently encountered. GRA

N77-21871# Logicon, Inc., Dayton, Ohio.
MANAGEMENT GUIDE TO AVIONICS SOFTWARE ACQUISITION. VOLUME 2: SOFTWARE ACQUISITION PROCESS Final Report, Jan. 1975 - May 1976
Jun. 1976 120 p
(Contract F33657-76-C-0234; AF Proj. 2257)
(AD-A030592; R:RW-75002-2-Vol-2; ASD-TR-76-11-Vol-2)
Avail: NTIS HC A06/MF A01 CSCL 01/3

Software Acquisition Process. This volume discusses the details of the avionics software acquisition process, its major milestones and decision points, pertinent Air Force technical and management activities, and software verification and validation. Author (GRA)

N77-21872# General Research Corp., Santa Barbara, Calif.
STRUCTURED PROGRAMMING TRANSLATORS, VOLUME 1 Final Technical Report, May 1975 - Jan. 1976
R. A. Melton Aug. 1976 36 p refs 5 Vol.
(Contract F30602-75-C-0245; AF Proj. 3201)
(AD-A031457; RADC-TR-76-253-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 09/2

Structured programming translators, STRUCTRAN-1 and STRUCTRAN-2, are tools which facilitate structured programming using the FORTRAN language. STRUCTRAN is a processor which accepts a structured language, DMATRAN, and is a precompiler for FORTRAN. DMATRAN contains five structured statement forms which can be mixed with ordinary FORTRAN constructs in the input text stream. To enhance readability of the processed source code, STRUCTRAN-1 automatically indents the listing of the source code according to control nesting level. To facilitate the translation of existing FORTRAN V programs into structured program form, STRUCTRAN-2 was developed. STRUCTRAN-2 provides the ability to translate unstructured control forms into logically equivalent structured control forms. The precompiler (STRUCTRAN-1) and the translator (STRUCTRAN-2) were developed at GRC on a CDC 6400. Implementation and demonstration were on a Univac 1108 series computer at the Defense Mapping Agency Aerospace Center (DMAAC), St. Louis, Missouri. STRUCTRAN-1 uses ASA Standard FORTRAN X3.9. STRUCTRAN-2 accepts Univac 1108 FORTRAN V programs. The government has unlimited data rights to the two programs, STRUCTRAN-1 and STRUCTRAN-2, delivered under this contract. Author (GRA)

N77-21873# General Research Corp., Santa Barbara, Calif.
STRUCTURED PROGRAMMING TRANSLATORS. VOLUME 2: STRUCTRAN-1 USER'S MANUAL Final Technical Report, May 1975 - Jan. 1976
D. M. Andrews, R. A. Melton, and R. J. Urban Aug. 1976 28 p 5 Vol.
(Contract F30602-75-C-0245; AF Proj. 3201)
(AD-A031458; RADC-TR-76-253-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 09/2

The STRUCTRAN-1 User's Manual describes the various structured constructs and statement syntax of DMATRAN, a structured extension to FORTRAN. It also details the use of the STRUCTRAN-1 preprocessor, which translates DMATRAN into pure FORTRAN. Procedures for using either the machine independent or Univac 1108 adapted versions of STRUCTRAN-1 are included. Author (GRA)

N77-21874# General Research Corp., Santa Barbara, Calif.
STRUCTURED PROGRAMMING TRANSLATORS. VOLUME 3: STRUCTRAN-1 SYSTEM DESIGN AND IMPLEMENTATION MANUAL Final Technical Report, May 1975 - Jan. 1976
D. M. Andrews and R. A. Melton Aug. 1976 20 p 5 Vol.
(Contract F30602-75-C-0245; AF Proj. 3201)
(AD-A031459; RADC-TR-76-253-Vol-3) Avail: NTIS HC A02/MF A01 CSCL 09/2

The STRUCTRAN-1 System Design and Implementation Manual provides a high-level description of the processing performed by STRUCTRAN-1, defines STRUCTRAN-1 file usage,

and documents the use of common variables by STRUCTRAN-1. Appendix A describes the function of STRUCTRAN-1 subroutines in detail. GRA

N77-21875# General Research Corp., Santa Barbara, Calif.
STRUCTURED PROGRAMMING TRANSLATORS. VOLUME 4: STRUCTRAN-2 USER'S MANUAL Final Technical Report, May 1975 - Jan. 1976
R. A. Melton Aug. 1976 23 p 5 Vol.
(Contract F30602-75-C-0245; AF Proj. 3201)
(AD-A031460; RADC-TR-76-253-Vol-4) Avail: NTIS HC A02/MF A01 CSCL 09/2

STRUCTRAN-2 is a system which converts unstructured FORTRAN programs into structured form. The STRUCTRAN-2 User's Manual describes the use and operation of this system. STRUCTRAN-2 is compatible with the STRUCTRAN-1 precompiler which is a special purpose language preprocessor intended to augment standard FORTRAN and permit its use as the basis of a structured programming effort. GRA

N77-21876# General Research Corp., Santa Barbara, Calif.
STRUCTURED PROGRAMMING TRANSLATORS. VOLUME 5: STRUCTRAN-2 SYSTEM DESIGN AND IMPLEMENTATION MANUAL Final Technical Report, May 1975 - Jan. 1976
C. Gannon and R. A. Melton Aug. 1976 63 p 5 Vol.
(Contract F30602-75-C-0245; AF Proj. 3201)
(AD-A031461; RADC-TR-76-253-Vol-5) Avail: NTIS HC A05/MF A01 CSCL 09/2

The STRUCTRAN-2 System Design and Implementation Manual describes the overall design of the STRUCTRAN-2 translator, and the organization and contents of the STRUCTRAN-2 data base. This manual is extended primarily for use in STRUCTRAN-2 software maintenance. Author (GRA)

N77-21877# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
BRACKETING DISCRETE PROBLEMS BY TWO PROBLEMS OF LINEAR OPTIMIZATION
Robert Jeroslow Jul. 1976 20 p refs
(Contract N00014-75-C-0621; Grant NSF GP-37510)
(AD-A032163; RR-395) Avail: NTIS HC A02/MF A01 CSCL 09/2

Two results are proven: (1) If a certain restricted problem of first-order error analysis in linear programming (specified below), for errors in only the criterion function, has a polynomial-time algorithm, then so does the tautology problem; (2) If the tautology problem is decidable in polynomial time, then linear programs can be solved optimally in polynomial time. GRA

N77-21878# Boston Coll., Chestnut Hill, Mass. Space Data Analysis Lab.
A FORTRAN FOR SOLVING SYSTEMS OF COUPLED SECOND-ORDER DIFFERENTIAL EQUATIONS WITH TWO-POINT BOUNDARY CONDITIONS
Jeffrey M. Forbes and Henry B. Garrett 1 Aug. 1976 37 p refs
(Contract F19628-76-C-0059)
(AD-A031498; BC-SDAL-77-1; Scientific-1; AFGL-TR-76-0205) Avail: NTIS HC A03/MF A01 CSCL 09/2

A computer program suitable for use on the DCD 6600 computer has been developed that solves a system of second-order ordinary differential equations with two-point boundary conditions. The program is highly adaptable and can readily be altered to solve a wide variety of second-order partial or ordinary differential equations. GRA

N77-21879# Florida Univ., Gainesville. Dept. of Computer and Information Sciences.
PRELIMINARY SPECIFICATION OF REAL-TIME PASCAL Final Report, Oct. 1975 - Jul. 1976
Gilbert J. Hansen and Charles E. Lindahl Jul. 1976 89 p refs
(Contract N61339-76-C-0017)
(AD-A031451; NAVTRAEQUIPC-76-C-0017-1) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report is the preliminary specification of the PASCAL based language, Real-Time PASCAL, which is designed to meet the requirements of real-time training device applications. The language is an amalgamation of ideas that for the most part have already been proved to be effective and useful. Modifications and extensions were incorporated in a manner consistent with the style of PASCAL. They mainly consist of the introduction of concurrent processes and constructs to control their creation, termination, scheduling and synchronization; real-time control; and different primitives for performing I/O. The language features permit a user to program a stand alone system assuming no underlying operating system support. Requisite operations system features can be built upon the kernel of real-time PASCAL which performs process management, memory management, I/O management, real-time control, and gives exclusive access to monitors. Further research effort is recommended to develop better language facilities for I/O exceptional conditions, allocation of processors to concurrent processes and protection mechanisms. GRA

N77-21880# Transportation Systems Center, Cambridge, Mass.
PROGRAM MULTI: A MULTI-PURPOSE PROGRAM FOR COMPUTING AND GRAPHING ROOTS AND VALUES FOR ANY REAL FUNCTION: USER/PROGRAMMERS MANUAL Final Report, Jul. - Dec. 1975
Russel Brantman May 1976 54 p
(PB-261121/8; DOT-TSC-FRA-76-1; FRA/ORD-76-143) Avail: NTIS HC A04/MF A01 CSCL 09B

A generalized multi purpose program was developed that is used to compute and graph cross sections of any surface in space, or to compute and graph the roots of any equation and any functions of these roots. This capability is unique among graphing programs, and it greatly facilitates the analysis of any system with multiple equilibrium branches. The program is especially suited for computing the equilibrium branches and investigating the stability of nonlinear finite degree of freedom systems subjected to static loads. The program is oriented towards systems with one or two degrees of freedom, but it also handles additional degrees of freedom and any number of parametric variables. GRA

N77-21881# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
A USERS MANUAL FOR THE 1-D HEAT CONDUCTION CALCULATOR PROGRAM Final Report, 10 Mar. 1975 - 10 Mar. 1976
John C. Sparks Aug. 1976 71 p refs
(AF Proj. 1367)
(AD-A032036; AFFDL-TR-76-69) Avail: NTIS HC A04/MF A01 CSCL 20/13

A finite difference heat conduction program for small (8-K) calculators is presented. Features include dynamic user control of the solution process and quick turn-around which speed preliminary design. The program is written in BASIC for the HP9830 calculator system equipped with Matrix ROM and 9862A Plotter. Programming techniques described may be applied to any small system having function keys or an equivalent interrupt capability. GRA

N77-21882# Naval Research Lab., Washington, D. C. Communications Sciences Div.
LISTENER PREFERENCE AND COMPREHENSION TESTS OF STRESS ALGORITHMS FOR A TEXT-TO-PHONETIC SPEECH SYNTHESIS PROGRAM Interim Report
Astrid McHugh 9 Sep. 1976 25 p refs
(NRL Proj. B02-15; RF21211401)
(AD-A031391; NRL-8015) Avail: NTIS HC A02/MF A01 CSCL 17/2

Six different stress algorithms were tested to find a relatively simple set of rules that would work well with a text-to-phonetic program of limited size. Algorithms using spelling rules only (no lexical, syntactic, or semantic information) were compared with a monotone and with hand-placed stress (English pronunciation rules). In the preference test, an algorithm that uses statistical regularities in English to assign stress and timing was judged better than a monotone, random stress, and strictly alternating stress. Hand-placed stress was judged better than this algorithm only when combined with timing rules. Comprehension tests revealed differences only with unpracticed subjects, for whom

the pattern of results was similar to that of the preference tests. Author (GRA)

N77-21883# Weiler Research, Inc., Mountain View, Calif.
ORACLE: A 2-DIMENSIONAL, 3-DIMENSIONAL FINITE ELEMENT COMPUTER PROGRAM FOR THE LINEAR ELASTIC, THERMAL STRESS ANALYSIS OF SOLID CONTINUA, USERS MANUAL Final Report
Frank C. Weiler 4 Jul. 1976 64 p
(Contract N60921-76-C-0177; SEA Proj. 184-572-014-1B; SF32322507)
(AD-A031588; WRI-76-1) Avail: NTIS HC A04/MF A01 CSCL 20/11

The input data and formats are described for the ORACLE finite element computer program. This program may be used for the linear elastic, thermal stress analysis of solid continua. The element library contains 3-dimensional solid elements with displacement representations varying from linear to full quadratic Also included are plane strain/stress elements and axisymmetric ring elements with similar displacement variations for analysis of 2-dimensional problems. Provision also exists for a 3-dimensional and a 2-dimensional user supplied element. Material properties are temperature dependent and general orthotropic. An option is provided to permit the property temperature dependence to vary within the element or the element may be treated as isothermal with constant properties. Thermal loads, pressures, concentrated forces or specified displacements may be applied. GRA

N77-21884# Army Computer System Command, Fort Belvoir, Va.
PROGRAMMING PROCEDURES MANUAL
14 Jun. 1976 607 p refs Revised
(AD-A032798; USACSC-Manual-18-1-1-Change-5) Avail: NTIS HC A99/MF A01 CSCL 09/2

This document prescribes procedures to be used by programers in developing and maintaining multicommand or command unique USACSC managed systems. It will be used as the primary source of information for CSC programers. GRA

N77-21885# Purdue Univ., Lafayette, Ind. Lab. for Applied Industrial Control.
A LANGUAGE COMPARISON. A COMPARISON OF THE PROPERTIES OF THE PROGRAMMING LANGUAGES ALGOL 68, CAMAC-IML, CORAL 66, PAS 1, PEARL, PL/1, PROCOL, RTL/2 IN RELATION TO REAL TIME PROGRAMMING
R. Roessler and K. Schenk Oct. 1976 447 p refs
(Contract N00014-76-C-0732)
(AD-A032571) Avail: NTIS HC A19/MF A01 CSCL 09/2

A comparison of the key features of eight well known real time programming languages in relation to their use for industrial computer systems. Author (GRA)

N77-21886# Stanford Univ., Calif. Dept. of Operations Research.
DECOMPOSITION IN INTEGER PROGRAMMING
Gary A. Kochman Sep. 1976 159 p refs
(Contracts N00014-76-C-0418; DAAC29-74-C-0034)
(AD-A033114; TR-66) Avail: NTIS HC A08/MF A01 CSCL 09/2

Contents: Resource Decomposition: A Conceptual Outline; Branching in the Rudimentary Branch-and-Bound Algorithm; Computing Bounds: Single Linking Constraint Case; Computing Bounds: Multiple Linking Constraints Case; Computational Results; and Conclusions, Extensions, and Areas for Future Research. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N77-21887*# Environmental Research Inst. of Michigan, Ann Arbor.
MIDAS, PROTOTYPE MULTIVARIATE INTERACTIVE DIGITAL ANALYSIS SYSTEM FOR LARGE AREA EARTH RESOURCES SURVEYS. VOLUME 1: SYSTEM DESCRIPTION Final Report, Apr. 1974 - Sep. 1975
D. Christenson, M. Gordon, R. Kistler, F. Kriegler, S. Lampert, R. Marshall, and R. McLaughlin Washington NASA Apr. 1977 136 p
(Contract NAS1-13128)
(NASA-CR-2730; ERIM-108800-49-F-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 09B

A third-generation, fast, low cost, multispectral recognition system (MIDAS) able to keep pace with the large quantity and high rates of data acquisition from large regions with present and projected sensots is described. The program can process a complete ERTS frame in forty seconds and provide a color map of sixteen constituent categories in a few minutes. A principle objective of the MIDAS program is to provide a system well interfaced with the human operator and thus to obtain large overall reductions in turn-around time and significant gains in throughput. The hardware and software generated in the overall program is described. The system contains a midi-computer to control the various high speed processing elements in the data path, a preprocessor to condition data, and a classifier which implements an all digital prototype multivariate Gaussian maximum likelihood or a Bayesian decision algorithm. Sufficient software was developed to perform signature extraction, control the preprocessor, compute classifier coefficients, control the classifier operation, operate the color display and printer, and diagnose operation. Author

N77-21888# Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
FEASIBILITY STUDY OF NETWORKS Progress Report, 15 Jul. 1975 - 14 Jul. 1976
Elizabeth J. Campbell, M. Kannel, and K. Saffran 30 Apr. 1976 62 p
(Contract E(11-1)-2487)
(COO-2487-3) Avail: NTIS HC A04/MF A01

The implications of computer resource sharing via networks were studied. Experiments performed on the ARPA net and experiments in more conventional forms of remote job entry to that site are described. Plans for future experiments in the ARPA net and for investigation of networks other than the ARPA net are proposed. The conclusion was reached that resource sharing via networks is both feasible and desirable provided certain interface problems are solved. Recommendations are made for more investigation into the human factors involved in network use, methods of providing consulting help to users, and determination of the most cost effective use of remote resource sharing. Remote resource sharing can be used only to supplement the on site computer, not replace it. At the present time, the best method of accessing the ARPA net for users is via the MIT Multics System. ERA

N77-21889# National Physical Lab., Teddington (England). Div. of Computer Science.
THE NATIONAL PHYSICAL LABORATORY DATA COMMUNICATION NETWORK
R. A. Scantlebury and P. T. Wilkinson Dec. 1976 16 p refs
(NPL-Com-85) Avail: NTIS HC A02/MF A01

The NPL data communication network provides a common carrier service on the laboratory site. It is organized to offer communications facilities, both to computers and to terminal devices of a wide variety, using the store-and-forward packet switched method of operation. At present there are 12 computers attached to the network, some of which make services available to terminals and to other computers; there are also about 75 terminals attached. The logical structure of the network provides separate mechanisms for handling computer and terminal subscribers. Two levels of protocol have been designed to control the intercommunication of computers and the communication between terminals and computers. Author (ESA)

N77-21890# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
EDIT: AN INTERACTIVE NETWORK SERVICE. DESIGN AND IMPLEMENTATION
A. L. Hillman and D. Schofield Oct. 1976 26 p refs
(NPL-NAC-70) Avail: NTIS HC A03/MF A01

EDIT is a timesharing system which offers interactive services

over the NPL network. These services include various kinds of editing, word processing, data movement, and file control. The system is implemented on a PDP 11/40 and can serve up to 30 users simultaneously, on high speed displays and other terminals. There is an attached background processor (PDP 11/45) which supports graphics and background jobs. The implementation of EDIT is described and related to the needs of the system and of its users. Author (ESA)

N77-21891# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
DYNAMIC FILE ALLOCATION IN A COMPUTER NETWORK M.S. Thesis
Francisco deAsis Ros Peran Jun. 1976 182 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A031608; ESL-R-667) Avail: NTIS HC A09/MF A01 CSCL 09/2

One of the main reasons computer networks are a major area of great attention and development today is their capability to provide the facilities for common use of data bases and information files by all computers in the system. When a file is used by several computers in the network, it can be stored in the memory of at least one of them and can be accessed by the other computers via the communication channels. In general, the cost or querying is reduced as we increase the number of copies in the system. On the other hand, storage costs, limitations on the size of the memories, and the cost of updating (every copy must be updated) will dictate decreasing of the number of copies. This thesis considers the problem of optimal dynamic file allocation when more than one copy is allowed to exist in the system at any given time. The use of two types of control variables, one for adding new copies to the system and the other for erasing copies, gives the model certain properties that permit the construction of an efficient algorithm to solve the optimization problem. In the last chapter, the model and algorithms are applied to several numerical examples. GRA

N77-21892# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
DIFFUSION MODELS FOR COMPUTER-COMMUNICATION NETWORKS M.S. Thesis
Jose Heredia Barbera May 1976 142 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A031551; ESL-R-661) Avail: NTIS HC A07/MF A01 CSCL 09/2

The diffusion theory is used to model a computer-communication network in which messages flow from one computer center to another. The idea is to approximate the various queuing processes that occur in the system (of discrete nature themselves) as continuous-state processes. The messages waiting at the queues to be transmitted are considered of small duration so that in the limit the flow of messages is continuous. With these ideas, a general model for routing of messages in a computer network is established and expressions for the diffusion parameters (drift and covariance per unit time) are derived in terms of the network traffic. The mean length of the queues can thus be calculated and procedures to minimize the system overall queue size may be applied. Examples for simple networks are shown. One of them corresponds to a load-sharing computer system, and it is indicated how the general diffusion methods, derived earlier for message routing, can be used. Finally, a comparison is made between the expressions obtained by diffusion techniques and those corresponding to the classical exponential M/M/1 queue. Author (GRA)

N77-21893# EDUCOM, Princeton, N. J.
SIMULATION AND GAMING PROJECT FOR INTER-INSTITUTIONAL COMPUTER NETWORKING, VOLUME 1 Final Report, 15 Feb. 1975 - 30 Jun. 1976
James C. Emery, Ronald Segal, Norman R. Nielsen, Robert Ashenhurst, and Sanford V. Berg Jul. 1976 189 p refs
(Grant NSF DCR-75-03634)
(PB-259789/6; EDUCOM-76.074-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 09B

The results of the first year of the three year study are reported. Included in this phase were the development of representational concepts, the design and implementation of the basic simulation model, the collection of data from the participating institutions, and the conduct of some preliminary experiments using the model. GRA

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N77-21894*# Honeywell, Inc., Minneapolis, Minn.
STUDY OF SYNTHESIS TECHNIQUES FOR INSENSITIVE AIRCRAFT CONTROL SYSTEMS Final Report, Dec. 1974 - Oct. 1976
C. A. Harvey and R. E. Pope Washington NASA Apr. 1977 310 p refs
(Contract NAS1-13680)
(NASA-CR-2803; HONEYWELL-76SRC37) Avail: NTIS HC A15/MF A01 CSCL 01D

Insensitive flight control system design criteria was defined in terms of maximizing performance (handling qualities, RMS gust response, transient response, stability margins) over a defined parameter range. Wing load alleviation for the C-5A was chosen as a design problem. The C-5A model was a 79-state, two-control structure with uncertainties assumed to exist in dynamic pressure, structural damping and frequency, and the stability derivative, M sub w. Five new techniques (mismatch estimation, uncertainty weighting, finite dimensional inverse, maximum difficulty, dual Lyapunov) were developed. Six existing techniques (additive noise, minimax, multiplant, sensitivity vector augmentation, state dependent noise, residualization) and the mismatch estimation and uncertainty weighting techniques were synthesized and evaluated on the design example. Evaluation and comparison of these six techniques indicated that the minimax and the uncertainty weighting techniques were superior to the other six, and of these two, uncertainty weighting has lower computational requirements. Techniques based on the three remaining new concepts appear promising and are recommended for further research. Author

N77-21895*# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
CLOSED-LOOP STRUCTURAL STABILITY FOR LINEAR-QUADRATIC OPTIMAL SYSTEM
Poh Kam Wong and Michael Athans Dec. 1976 10 p refs Presented at IEEE Conf. on Decision and Control, Clearwater Beach, Fla., Dec. 1976
(Grants NGL-22-009-124; AF-AFOSR-2273-72)
(NASA-CR-152664; AD-A033384; AFOSR-76-1237TR) Avail: NTIS HC A02/MF A01 CSCL 12/2

This paper contains an explicit parameterization of a subclass of linear constant gain feedback maps that will not destabilize an originally open-loop stable system. These results can then be used to obtain several new structural stability results for multi-input linear-quadratic feedback optimal designs. Author (GRA)

N77-21896# California Univ., Livermore. Lawrence Livermore Lab.
APPLICATION OF PATTERN RECOGNITION TECHNIQUES TO CRIME ANALYSIS
C. F. Bender, L. A. Cox, Jr., and G. A. Chappell 15 Aug. 1976 60 p refs
(Contract W-7405-eng-48)
(UCID-17224) Avail: NTIS HC A04/MF A01

Performance was evaluated both in terms of the system's capability to predict crimes and to optimize police manpower allocation. A relation was sought to predict the crime's susceptibility to solution, based on knowledge of the crime type, location, time, etc. The preliminary results are discussed. They indicate that automatic crime analysis involving pattern recognition techniques is feasible, and that efforts to determine optimum variables and techniques are warranted. ERA

N77-21897# National Aerospace Lab., Amsterdam (Netherlands). Space Flight Div.
SURVEY OF MODERN CONTROL AND OBSERVATION THEORY FOR DISTURBED, TARGET FOLLOWING AEROSPACE SYSTEMS. PART 1: BASIC THEORY

P. T. L. M. vanWoerkom 30 Mar. 1976 150 p refs
(Contract NIVR-1780)
(NLR-TR-76041-U) Avail: NTIS HC A07/MF A01

A general approach towards the observation and optimal control of high accuracy, disturbed, target-following aerospace systems is described, with special emphasis on space vehicle applications. Disturbed, target-following aerospace systems are defined as aerospace systems that are designed to track a moving target system, while they are subjected to external, time-varying disturbances. State space modelling, design of control theory, and the theory of (fullorder) observers are discussed. These modern concepts are applied to the design of control for disturbed, target-following systems. Control is of the bi-modal type, using observer-generated estimates of the state error and of the external disturbance. A critical discussion of some relevant literature is presented together with numerous examples from the area of aerospace vehicle observation and control with emphasis on space vehicle applications. Author (ESA)

N77-21898# Pattern Analysis and Recognition Corp., Rome, N.Y.
THE WAVEFORM PROCESSING SYSTEM. USER'S MANUAL FOR THE WAVEFORM PROCESSING SYSTEM Final Report
Probal K. Sanyal, C. Berster, T. McGibbon, L. Rosenhand, and J. Skelly Sep. 1976 577 p
(Contract F30602-72-C-0193)
(AD-A032305; PAR-76-6; RADC-TR-76-224-Vol-2) Avail: NTIS HC A24/MF A01 CSCL 09/2

This report constitutes the User's Manual for the Waveform Processing System (WPS) developed by Pattern Analysis and Recognition Corporation for the Rome Air Development Center under Contract F30602-72-C-0193. The Waveform Processing System consists of (1) algorithms for performing mathematical operations on waveform data, (2) a language for extracting feature vectors from the waveform, and (3) algorithms for analyzing these vectors to develop pattern classification logic.
Author (GRA)

N77-21899# Naval Research Lab., Washington, D. C.
A 600-BIT-PER-SECOND VOICE DIGITIZER (LINEAR PREDICTIVE FORMANT VOCODER) Interim Report
George S. Kang and David C. Coulter 4 Nov. 1976 38 p refs
(AD-A033492; NRL-8043) Avail: NTIS HC A03/MF A01 CSCL 17/2

Past efforts to achieve practical formant vocoders have been plagued with problems of formant tracker instability, resulting in unnatural warbles in the synthesized speech. A new approach to formant frequency determination, combined with a digital implementation, promises to eliminate these effects and to yield a useful formant vocoder. Additional redundancy reduction of information is obtained by means of a pattern-matching technique, which encodes the three formant frequencies into seven bits per frame to provide speech synthesis at 600 bps. This is accomplished by using an existing 2,400-bps linear-predictive-encoder (LPE) with some additional processing. A demonstration record of processed speech at 600 bps is included with the report. Author (GRA)

N77-21900# Rice Univ., Houston, Tex. Dept. of Electrical Engineering.
FEATURE EXTRACTION AND CLASSIFICATION RESULTS FOR THE BATCHELOR-HAND-BRUMFITT ARTIFICIAL DATA BASE
S. A. Starks, K. C. Pau, and R. J. P. DeFigueiredo Oct. 1976 21 p refs
(Grant AF-AFOSR-2777-75; AF Proj. 2304)
(AD-A032897; EE-TR-7610; AFOSR-76-1230TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

A study is presented on the performance of feature extractors and classifiers on the 10-dimensional artificial data base provided by B. G. Batchelor, D. J. Hand, and P. G. Brumfitt of the Department of Electronics, University of Southampton, Southampton. On feature extraction, specifically three techniques for the extraction of the best one dimensional subspace were examined on the above data: the single linear feature (SLF) extraction algorithm developed at Rice; the single feature (SFB) corresponding to the maximum Bhattacharyya distance between pattern classes; and the optimal Karhunen-Loeve (KLF) subspace. Classification performance on the test set was 73.2% for SLF, 66.2% for SFB, Classification in subspace of dimension greater than one was also investigated. In the entire 10-dimensional space, a classification performance of 80.8% was attained using maximum likelihood classifier. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N77-21901# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
A NUMERICAL SCHEME TO SOLVE UNSTABLE BOUNDARY VALUE PROBLEMS
Eugenia Kalnay-Rivas [1977] 5 p refs
Avail: NTIS HC A02/MF A01

A scheme for solving boundary value problems is presented. It converges under more general conditions than relaxation schemes based on forward time integration, and in particular it is used to obtain unstable steady state solutions of the hydrodynamic equations. Author

N77-21902*# Scientific Translation Service, Santa Barbara, Calif.
THE EFFECTS OF CONTEMPORANEOUS AND NON-CONTEMPORANEOUS CORRELATION ON THE ESTIMATION OF A SYSTEM OF REGRESSION EQUATIONS
E. Abdel-Badie and F. M. Abdel-Fatah Apr. 1977 19 p refs
Transl. into ENGLISH from Rev. Statist. Appl., France, v. 22, no. 2, 1974 p 69-80
(Contract NAS7-100)
(NASA-TT-F-16774) Avail: NTIS HC A02/MF A01 CSCL 12A

The problem of obtaining efficient estimators of the parameters of a system of M regression equations is considered. It is assumed that the perturbation terms of this system are simultaneously related by serial correlations and contemporaneous correlations. With the additional hypothesis that the serial correlation is a first order auto-regression process, a conversion estimator is outlined. This estimator has the same normal asymptotic distribution as the Aitken estimator, which assumes that the covariance matrix is known. The results in the case of a system of two regression equations are evaluated. Author

N77-21903# Sandia Labs., Albuquerque, N.Mex.
DETECTING STIFFNESS WITH THE FEHLBERG (4,5) FORMULAS
Lawrence F. Shampine and K. L. Hiebert Sep. 1976 17 p refs
(Contract E(29-1)-789)
(SAND-76-0392) Avail: NTIS HC A02/MF A01

The Fehlbert (4,5) formulas appear to be the most effective Runge-Kutta formulas of moderate order for the solution of nonstiff ordinary differential equations. A simple, cheap scheme is developed for codes based on these formulas which detects stiffness with considerable reliability. If a user accidentally or unknowingly tries to integrate a stiff problem, a code with this scheme can warn him that it will be extremely inefficient and that he should switch to a code aimed specifically at such problems. ERA

N77-21904# Sandia Labs., Albuquerque, N.Mex.
CONVOLUTION METHOD FOR LEAST-SQUARES-FIT SMOOTHING AND DIFFERENTIATION OF DIGITAL DATA
H. H. Madden and D. G. Schreiner Aug. 1976 58 p refs
(Contract E(29-1)-789)
(SAND-76-0283) Avail: NTIS HC A04/MF A01

The use of digital computers for this type of numerical filtering and for determining smoothed derivatives was first discussed by Savitzky and Golay (Anal. Chem. 36, 1627 (1964)). Methods for extending the widths of the convolution arrays beyond the 25-point-width maximum of Savitzky and Golay are presented. It also gives corrections to errors in their paper. Three new

algebraic equations are derived that can be used to determine the convolution array coefficients for determining the smoothed first, second, and third derivative values by least-squares-fitting to a quadratic/cubic polynomial. Two simple tests for determining errors in least-squares-fit convolution arrays are given. The use of these convolution arrays for processing digital data is illustrated by examples that make use of a Rutherford backscattering spectrum from a cobalt molybdate catalyst. ERA

N77-21905# Oak Ridge National Lab., Tenn.
ALPS: CLASSES OF STABLE AND SEMIPOSITIVE MATRICES
Abraham Berman and R. C. Ward Oct. 1976 29 p refs
(Contract W-7405-eng-26)
(ORNL-CSD-14) Avail: NTIS HC A03/MF A01

Various degrees of stability and semipositivity for real square matrices are described. The standard conditions for three major classes of matrices are made both stronger and weaker, and the resulting classes are examined. The major classes are diagonally stable, stable, and semipositive matrices denoted by A, L, and S, respectively. Their relationship to the classes of matrices whose principal minors are positive, denoted by P, and non-negative, noted by P/sub o/, is also presented. ERA

N77-21906# Oak Ridge National Lab., Tenn.
MATHEMATICS AND STATISTICS RESEARCH DEPARTMENT Progress Report, Period Ending 30 Jun. 1976
D. G. Gosslee, comp., B. K. Shelton, comp., R. C. Ward, comp., and D. G. Wilson, comp. Oct. 1976 76 p
(Contract W-7405-eng-26)
(ORNL-CSD-13) Avail: NTIS HC A05/MF A01

Research in mathematics and statistics concerned statistical estimation, statistical testing, experiment design, probability, continuum mechanics, functional integration, matrices and other operators, and mathematical software. More applied studies were conducted in the areas of analytical chemistry, biological research, chemistry and physics research, energy research, environmental research, health physics research, materials research, reactor and thermonuclear research, sampling inspection, quality control, life testing, and uranium resource evaluation research. Additional sections deal with educational activities, presentation of research results, and professional activities. ERA

N77-21907# Illinois Univ., Urbana. Dept. of Computer Science.
NUMERICAL SOLUTION OF STIFF ORDINARY DIFFERENTIAL EQUATIONS USING COLLOCATION METHODS Ph.D. Thesis
Bruce David Link Jun. 1976 113 p refs
(Contract E(11-1)-2383)
(COO-2383-0032; UIUCDCS-R-76-813) Avail: NTIS HC A06/MF A01

The order and stability regions of these methods are characterized. The methods are stable and convergent for infrequent formula changes and small stepsize changes. Block multistep methods which are stiffly stable up to order 24 and several families of multistep methods stiffly stable up to order 9 exist. A similar class of quadrature methods includes a family with the same stability regions as Enright's second derivative methods but only requires first derivatives. ERA

N77-21908# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
HIGH ORDER FAST LAPLACE SOLVERS FOR THE DIRICHLET PROBLEM ON GENERAL REGIONS
V. Pereyra (California Inst. of Technol., Pasadena), W. Proskurowski (Royal Inst. of Technol., Stockholm), and O. Widlund May 1975 36 p refs
(Contracts E(11-1)-3077; E(04-3)-326; W-7405-eng-48)
(COO-3077-122) Avail: NTIS HC A03/MF A01

Highly accurate finite difference schemes are developed for Laplace's equation with the Dirichlet boundary condition on general bounded regions in R/sup n/. A second order accurate scheme is combined with a deferred correction or Richardson extrapolation method to increase the accuracy. The Dirichlet condition is approximated. A convergence proof is presented. The linear systems of algebraic equations are solved by a capacitance matrix method. The results of our numerical experiments show that highly accurate solutions are obtained with only a slight additional use of computer time when compared to the results obtained by second order accurate methods. ERA

N77-21909# Oak Ridge National Lab., Tenn. Computer Sciences Div.
FIFPC: A FAST ION FOKKER-PLANCK CODE
R. H. Fowler, J. D. Callen, J. A. Rome, and J. Smith Jul. 1976 105 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5487) Avail: NTIS HC A06/MF A01

A computer code is described which solves the Fokker-Planck equation for the velocity space distribution of fast ions injected into a Tokamak plasma. The numerical techniques are described, and use of the code is outlined. The program is written in FORTRAN 4 and is modularized in order to provide greater flexibility to the user. A program listing is provided, and the results of sample cases are presented. ERA

N77-21910# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.
THE USE OF APPLIED MATHEMATICS AT THE NATIONAL AEROSPACE LABORATORY (NLR)
W. Loeve 13 Apr. 1976 34 p refs Presented at the 12th Math. Congr., Amsterdam, 14-15 Apr. 1976
(NLR-MP-76005-U) Avail: NTIS HC A03/MF A01

A description is given of the type of use that is being made at NLR of applied mathematics. Some examples of this application are given for flow calculation, data processing of satellite observations, and aircraft man-machine interfaces. ESA

N77-21911# Grenoble Univ. (France). Lab. de Mathematiques Appliquees.
DEVELOPMENT OF SMOOTHING SPLINE FUNCTIONS FOR TELEMETRY DATA. VOLUME 1: THEORETICAL STUDIES [ETUDE DU DEVELOPPEMENT DES FONCTIONS-SPLINE DE LISSAGE POUR DES DONNEES DE TELEMESURE. VOLUME 1 (ETUDES THEORIQUES)]
P. J. Laurent Oct. 1975 37 p refs In FRENCH 3 Vol.
(Contract ESOC-553/73-AR)
(ESA-CR(P)-901-Vol-1) Avail: NTIS HC A03/MF A01

Four types of minimization problems are considered all leading to a solution belonging to the same vector subspace, called spline function space. The problems are the following: interpolation, smoothing, inequality type constraints, and association with a convex function. ESA

N77-21912# Grenoble Univ. (France). Lab. de Mathematiques Appliquees.
DEVELOPMENT OF SMOOTHING SPLINE FUNCTIONS FOR TELEMETRY DATA. VOLUME 2: NUMERICAL METHODS [ETUDE DU DEVELOPPEMENT DES FONCTIONS-SPLINE DE LISSAGE POUR DES DONNEES DE TELEMESURE. VOLUME 2 (METHODES NUMERIQUES)]
P. J. Laurent Sep. 1976 67 p refs In FRENCH 3 Vol.
(Contract ESOC-553/73-AR)
(ESA-CR(P)-901-Vol-2) Avail: NTIS HC A04/MF A01

A description is given of algorithms proposed for the calculation of four types of spline functions. Two efficient and fast algorithms are discussed for computation of interpolation and smoothing spline functions. Four different methods are proposed for dealing with spline functions with inequality type constraints: steepest descent, decomposition, dual, and internal penalty. An algorithm is also described for spline functions associated with a convex function. ESA

N77-21913# Grenoble Univ. (France). Lab. de Mathematiques Appliquees.
DEVELOPMENT OF SMOOTHING SPLINE FUNCTIONS FOR TELEMETRY DATA. VOLUME 3: PROGRAMS AND NUMERICAL RESULTS [ETUDE DU DEVELOPPEMENT DES FONCTIONS-SPLINE DE LISSAGE POUR DES DONNEES DE TELEMESURE. VOLUME 3 (PROGRAMMES ET RESULTATS NUMERIQUES)]
Claire DiCrescenzo Dec. 1976 92 p In FRENCH 3 Vol.
(Contract ESOC-553/73-AR)
(ESA-CR(P)-901-Vol-3) Avail: NTIS HC A05/MF A01

Computer programs are described for the calculation of four

types of spline functions performing minimization of interpolation, smoothing, inequality type constants, and association with convex function, based on previously developed algorithms. The methods used are compared from a numerical point of view. All the methods were written as a FORTRAN subprogram. ESA

N77-21914# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Spannungs- und Stabilitaetsprobleme.

NONLINEAR TRANSFORMATION MATRIX OF THE ELONGATED, BENT AND TWISTED ROD

Dieter Petersen 19 Nov. 1976 23 p ref In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-379)

(DLR-FB-76-62) Avail: NTIS HC A02/MF A01; DFVLR, Cologne, DM 12,20

The nonlinear transformation matrix between a reference system of coordinates and the coordinate system of a deformed rod which is fixed to the main axes of the cross section was established. If the geometrical nonlinearities in the case of bending in both directions which is variable along the length of the beam are taken into account, a nonlinear integral of deformation terms has to be solved. Thus, the determination of the initial value sometimes is difficult. The nonlinear approach for a rod with variable extension, bending, and twisting along its length is discussed, and the solution including terms of third order is given. Author (ESA)

N77-21915# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.

THE NUMERICAL EVALUATION OF A SPLINE FROM ITS B-SPLINE REPRESENTATION

M. G. Cox Jul. 1976 19 p refs Presented at the Bien. Conf. on Numerical Anal., Dundee, Scotland, July 1975

(NPL-NAC-68) Avail: NTIS HC A02/MF A01

Representations of polynomial splines as linear combinations of B-splines are eminently suitable for many numerical computations. The most fundamental calculation involving such a representation, its evaluation, is considered. It is shown that two schemes proposed for this task in the one-dimensional case are comparable both in efficiency and accuracy. For arbitrary knots and B-spline coefficients, the absolute errors in the computed values are guaranteed to be small; when the coefficients are of one sign, the relative errors are also small. An extension to two dimensions is made and it is shown that one scheme has superior efficiency in this case. Author (ESA)

N77-21916# Naval Research Lab., Washington, D. C. Plasma Dynamics Branch.

NUMERICAL SOLUTION OF THE PARABOLIC EQUATION WITH THE PEP CODE

B. E. McDonald Oct. 1976 23 p refs

(RR0330242)

(AD-A032046; NRL-MR-3385) Avail: NTIS HC A02/MF A01 CSCL 20/14

Proposed is a centered leapfrog difference scheme for solution of the parabolic equation for wave propagation in random media. Stability and resolution requirements for the scheme are given. Results of two numerical integrations are in good agreement with those obtained by others using different methods. GRA

N77-21917# Naval Research Lab., Washington, D. C.

AN ADAPTIVE MINIMUM VARIANCE FILTER FOR DISCRETE LINEAR SYSTEMS

A. J. Verderese Oct. 1976 49 p refs

(NRL Proj. G05-16)

(AD-A032035; NRL-MR-3380) Avail: NTIS HC A03/MF A01 CSCL 12/1

The main purpose of this report is to present a technique whereby standard Kalman filters can adapt to unknown noise statistics and hence an improvement on their workability and stability characteristics can be realized. The fundamental concept used herein is one of whitening of the realizations using a moving average filter. Through the execution of this process, details pertaining to the composition of the message process are ascertained. Adaptive filters based on the work of Shellenbarger, Sage, et al. using Bayesian techniques were also derived and their final algorithms presented being careful to mention any assumptions used throughout the development. Finally, simulation results were presented for the scalor case, when both the measurement and the process noise sources were unknown. These runs were quite successful in their accuracy and setting. Although the results obtained were based on linear, stationary systems, they do form a basis to enhance further growth in this complex, but important, area. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N77-21918# Rockwell International Corp., Anaheim, Calif. Metrology Lab.

SYSTEMATIC ERRORS IN MEASUREMENTS AND CALIBRATIONS

Rolf B. F. Schumacher 1976 13 p refs Presented at 6th Ann. Measurement Sci. Conf. at Cal-Poly, San Luis Obispo, Calif., 4 Dec. 1976

(X76-1237/101) Avail: NTIS HC A02/MF A01

The nature, origin, and treatment of systematic errors in measurements and calibrations are discussed. It is shown how systematic errors can vary, how random errors under one set of conditions will become systematic errors under another set of conditions and vice versa. Recommendations are made concerning the assignment of values to limits of systematic errors to measurements and standards. Author

N77-21919# Los Alamos Scientific Lab., N. Mex.

FITTING BETA PRIOR DISTRIBUTIONS IN BAYESIAN RELIABILITY ANALYSIS: A SET OF TABLES

M. S. Waterman, H. F. Martz, and R. A. Waller Jun. 1976 25 p refs

(Contract W-7405-eng-36)

(LA-6395-MS) Avail: NTIS HC A02/MF A01

Tables are provided for use in fitting beta prior distributions when conducting Bayesian reliability analyses based on success/failure life test data. The first table gives the beta parameters corresponding to prespecified values of the prior mean and the prior 95th percentile of the beta distribution. The second table gives the beta parameters corresponding to prespecified values of the prior mean and the prior 5th percentile of the beta distribution. ERA

N77-21920# Decisions and Designs, Inc., McLean, Va.

CALIBRATION OF PROBABILITIES: THE STATE OF THE ART

Sarah Lichtenstein (Oregon Research Inst.), Baruch Fischhoff (Oregon Research Inst.), and L. D. Phillips (Brunel Univ.) Aug. 1976 75 p refs

(Contract N00014-76-C-0074; ARPA Order 3052)

(AD-A033248; ORI-DDI-3) Avail: NTIS HC A04/MF A01 CSCL 12/2

An important criterion for evaluating probability assessors is their degree of calibration. A probability assessor is well calibrated if, over the long run, for all statements assigned a given probability, the proportion that is true is equal to the probability assigned. For example, if you are well calibrated, then across all the many occasions that you assign a probability of .8, in the long run 80% of them should turn out to be true. If, instead, only 70% are true, you are not well calibrated; you are overconfident. If 95% of them are true, you are underconfident. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N77-21921*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MODELING ERROR ANALYSIS OF STATIONARY LINEAR DISCRETE-TIME FILTERS

Rajnikant Patel and Mitsuhiko Toda Feb. 1977 23 p refs
(NASA-TM-X-73225; A-6908) Avail: NTIS HC A02/MF A01 CSCL 12B

The performance of Kalman-type, linear, discrete-time filters in the presence of modeling errors is considered. The discussion is limited to stationary performance, and bounds are obtained for the performance index, the mean-squared error of estimates for suboptimal and optimal (Kalman) filters. The computation of these bounds requires information on only the model matrices and the range of errors for these matrices. Consequently, a design can easily compare the performance of a suboptimal filter with that of the optimal filter, when only the range of errors in the elements of the model matrices is available. Author

N77-21922# Waterloo Univ. (Ontario). Solid Mechanics Div.
ON THE APPLICATION OF THE ENERGY METHOD TO THE STABILITY PROBLEM OF NONCONSERVATIVE AUTONOMOUS AND NONAUTONOMOUS SYSTEMS
H. H. E. Leipholz Sep. 1976 48 p refs
(Paper-141) Avail: NTIS HC A03/MF A01

The energy approach is extended to cover the stability problem of nonconservative mechanical systems. The eigenvalue curve is obtained by the condition that a certain matrix be singular, and flutter loads follow from the requirement that the derivative of the determinant of this matrix with respect to the frequency of the motion be zero. In the case where the nonconservative forces of the system tend toward zero, all conditions of this general theory change into the well known conditions of the classical theory of stability of conservative systems. The theory also allows for a post-buckling analysis and for the inclusion of nonautonomous systems. Author

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

No abstracts in this category.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N77-21923# Sandia Labs., Albuquerque, N.Mex.
EQUATIONS OF MOTION FOR FREE-FLIGHT SYSTEMS OF ROTATING-TRANSLATING BODIES
A. E. Hodapp, Jr. Sep. 1976 24 p refs
(Contract E(29-1)-789)
(SAND-76-0266) Avail: NTIS HC A02/MF A01

General vector differential equations of motion are developed for a system of rotating-translating, unbalanced, constant mass bodies. Complete flexibility is provided in placement of the reference coordinates within the system of bodies and in placement of body fixed axes within each body. Example cases are presented to demonstrate the ease in reduction of these equations to the equations of motion for systems of interest. ERA

N77-21924# Cornell Univ., Ithaca, N.Y. Dept. of Theoretical and Applied Mechanics.
MAGNETOELASTIC STABILITY AND VIBRATIONS OF SUPERCONDUCTING MAGNETS Progress Report, 1 Sep. 1975 - 31 Mar. 1976
F. C. Moon May 1976 36 p refs
(Contract E(11-1)-2780)
(COO-2780-1) Avail: NTIS HC A03/MF A01

Buckling and vibration problems in small superconducting models of Tokamak coils are studied. Observations are reported on thermoelastic buckling of epoxy potted superconducting coils producing significant out of plane deformations due to differences in thermal expansion coefficients. The damping of free vibrations in the coils is also investigated. ERA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N77-21925# Cambridge Univ. (England). Dept. of Engineering.
WIND-TUNNEL SIMULATION OF THE EFFECTS OF FLIGHT ON RADIATED SOUND
J. Jacques London Aeron. Res. Council 1976 76 p refs Supersedes ARC-36641
(ARC-CP-1351; ARC-36641) Avail: NTIS HC A05/MF A01; HMSO £2.30; PHI $9

The validity of wind-tunnel simulation of the noise radiated by a moving source is studied. Theoretical corrections are derived that allow acoustic measurements in a wind tunnel with microphones outside of the flow to be transposed to a real flight situation. Some corrected coaxial jet data are then compared with real flight data. Author (ESA)

N77-21926# Admiralty Underwater Weapons Establishment, Portland (England).
SPATIAL SAMPLING CRITERIA FOR NEARFIELD MEASUREMENTS MADE ON CYLINDRICAL SURFACES
Martin J. Earwicker London HMSO Sep. 1976 31 p refs
(AUWE-Publ-42341; BR55469) Avail: NTIS HC A03/MF A01

The spatial sampling criteria were established for nearfield sound measurements, made on a cylindrical surface enclosing the sources, that enable the farfield of those sources to be calculated faithfully from the nearfield data. Examples are given of the criteria applied to both omnidirectional and directional sources: their nearfield and calculated farfield. In general the common practice of using half wave length samples circumferentially is shown to be adequate for omnidirectional fields (narrow spatial bandwidths) but not adequate for the broad circumferential spatial bandwidth fields encountered with directional sources. The appropriate sampling criteria may be deduced from equations described. Author (ESA)

N77-21927# National Bureau of Standards, Washington, D. C. Inst. for Basic Standards.
ENVIRONMENTAL EFFECTS ON MICROPHONES AND TYPE II SOUND LEVEL METERS Final Report
Edward B. Magrab Oct. 1976 123 p refs
(PB-260721/6; NBS-TN-931) Avail: NTIS HC A06/MF A01 CSCL 14B

For four different manufacturer's Type II sound level meters, numerous experimentally determined data concerning the effects of frequency, temperature, angle of incidence of the sound, and types of ground cover and reflecting surfaces on sound level meter readings are presented. Data are also given for the effects of ambient barometric pressure on several manufacturers' acoustic calibrators, the effect of frequency and crest factor on the sound level meters' detector circuit, the linearity of the sound level meters' range potentiometer and meter scale, and the precision of the A-weighted response in a randomly incident (diffuse) sound field. Additional data are given concerning the effects of temperature and humidity on the sensitivity of electret, condenser, and ceramic microphones. Finally, important statistical concepts and recommended data monitoring procedures are presented to insure that the precision of repeated sound level measurements is known. GRA

N77-21928# Maryland Univ., College Park. Dept. of Physics and Astronomy.
NOISE MEASUREMENTS OF THE LOWEST FREQUENCY LONGITUDINAL MODE OF AN ALUMINUM CYLINDER AT LIQUID NITROGEN TEMPERATURES Annual Report, 1 Nov. 1975 - 31 Dec. 1976
Wm. S. Davis, Darrel Gretz, J-P. Richard, G. Rydbeck, and J. Weber Aug. 1976 26 p
(Contract N00014-76-C-04)
(AD-A032271) Avail: NTIS HC A03/MF A01 CSCL 20/12

The lowest frequency longitudinal mode of an aluminum cylinder has been studied over the temperature range 60 K -

78 K. Lead zirconate titanate crystals were bonded to the cylinder for observation of the thermal fluctuations, and relaxation phenomena. Large amounts of excess noise were observed whenever the cylinder was not in thermal equilibrium. The cylinder appeared to have attained thermal equilibrium after its temperature had been maintained near liquid nitrogen temperatures for several weeks. Noise temperatures within a factor 2 of the temperature measured by a platinum resistance thermometer were observed when the mean temperature of the cylinder was drifting less than 0.01 K per day. The very large fluctuations in noise temperature are not understood and warrant further investigation. Author (GRA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N77-21929# Brookhaven National Lab., Upton, N.Y.
INCOMMENSURATE LATTICE-INSTABILITY IN K2SeO4
M. Iizumi, J. D. Axe, G. Shirane, and K. Shimaoka (Japan Atomic Enery Res. Inst., Tokai, Japan) 1976 6 p refs
(Contract E(30-1)-16)
(BNL-21471; Conf-760601-5) Avail: NTIS HC A02/MF A01

Successive phase transformations in K2SeO4 at T/sub i/ = 130 K and T/sub c = 93 K were studied by the triple-axis neutron scattering technique. Spectrometric data on lattice instability on the P-phase are presented and discussed. Topics include soft mode dispersion relation, critical scattering, and the induction of spontaneous polarization. The incommensurate transition, simultaneous lock-in commensurate phase, and the ferroelectricity are discussed using a Landau type expansion of the free energy. ERA

N77-21930# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
INTERACTION OF HEAVY IONS WITH MATTER Progress Report Summary Report
John W. Boring and Robert E. Johnson Jul. 1976 126 p refs
(Contract E(40-1)-2911)
(ORO-2911-16; ESS-3930-113-76) Avail: NTIS HC A07/MF A01

The processes that occur when a heavy atomic particle (ion, atom, etc.) interacts with matter, particularly the effects produced on biological systems, were investigated, and results are reviewed. Areas covered include: energy loss, straggling, and stopping; projected ranges and first-order moments; damage cross section for inactivation of RNase; and spatial distribution of damage in RNase. History and objectives of the research program are included. Author (ERA)

N77-21931# California Univ., Livermore. Lawrence Livermore Lab.
MICROWAVE CROSS SECTION OF AN IONIZED CHANNEL
T. J. Fessenden, A. L. Skinner, and R. L. Spoerlein 12 Aug. 1976 25 p refs
(Contract W-7405-eng-48)
(UCID-17238) Avail: NTIS HC A02/MF A01

Measurements of the microwave cross section of the ionized channel created by an intense electron beam propagating in a high density gas are reported. Following a brief theoretical treatment, experimental values at normal incidence for back scattered, forward scattered, and 90 deg scattered cross section of the beam are reported at 24 GHz for air and nitrogen at 500 torr pressure. ERA

N77-21932# Yale Univ., New Haven, Conn. Dept. of Physics.
ELECTRON TRANSFER PROCESSES IN ION COLLISIONS WITH ATOMIC HYDROGEN Final Report, 1 Feb. 1975 - 30 Jun. 1976
J. E. Bayfield Jul. 1976 27 p refs
(Contract E(11-1)-2562)
(COO-2562-2) Avail: NTIS HC A03/MF A01

Electron transfer cross sections were measured at keV collision energies for B, C, N, and O ions colliding with H, H2, Ar, and He gas targets. The ion charge states studied range from +2 through +5. Also reported are cross sections for Si and Fe ions on H, H2, and Ar energies between 1.5 and 14 MeV, with charge states varying between +5 and +13. At keV energies the cross sections for highly charged B, C, N, and O ions are found to be 1 x 10 to the -14th power per sq. cm. The cross sections for 4 MeV Fe ions scale roughly with the square of the ion charge, and have values as high as 0.5 x 10 to the -14th power per sq. cm. for Fe(10+) + H collisions. A strong energy dependence is found for Fe ion collisions between 4 and 14 MeV. Previous results for MeV H(+) + Ar collisions are reproduced, while first results for the fundamental MeV H(+) - H collision problem are cross sections higher than many theoretical predictions. ERA

N77-21933# California Univ., Berkeley. Lawrence Berkeley Lab.
DYNAMICS OF THE REACTION OF THE N(+) ION WITH HYDROGEN ISOTOPES AND HELIUM Ph.D. Thesis
Walter Ernst William Ruska 28 Jun. 1976 174 p refs
(Contract W-7405-eng-48)
(LBL-5120) Avail: NTIS HC A08/MF A01

Molecular beam techniques were used to study the reactive and non-reactive scattering of the nitrogen positive ion from hydrogen isotopes and helium, at energies above the stability limit for spectator stripping. Reactive scattering was observed from H2 and HD targets. Non-reactive scattering was observed from H2 and D2 targets, and from He at one energy. A correlation diagram for the system is presented and compared with the available a priori calculations. Theoretical models are presented in which an incident hard sphere A, representing the projectile ion, strikes one of a pair of hard spheres B-C representing the B hydrogen molecule. After an impulsive A-B collision, an impulsive B-C collision may take place. The relative energy of A to B is then examined, and a reactive event is considered to have occurred if the energy is less than the dissociation energy for the A-B molecule. This model is treated both in the collinear case and in three dimensions. ERA

N77-21934# California Univ., Livermore. Lawrence Livermore Lab.
NONLINEAR RADIATION TRANSPORT PROBLEMS INVOLVING WIDELY VARYING MEAN FREE PATHS
G. Chapline, Jr. and L. Wood 30 Jul. 1976 15 p refs
(Contract W-7405-eng-48)
(UCID-17227) Avail: NTIS HC A02/MF A01

A method is given for modifying the Monte Carlo approach so that one can accurately treat problems that involve both large and small mean free paths. This method purports to offer the advantages of the general Monte Carlo technique as far as relatively great accuracy of simulation of microscopic physical phenomena is concerned, and the advantage of a diffusion theory approach as far as decent time steps in thick problems are concerned; it does suffer from something of the statistical fluctuation problems of the Monte Carlo, although in analytically attenuated and modified form. ERA

N77-21935# Oak Ridge National Lab., Tenn.
ANALYSIS OF A NEUTRON SCATTERING AND GAMMA-RAY PRODUCTION INTEGRAL EXPERIMENT ON OXYGEN FOR NEUTRON ENERGIES FROM 1 TO 15 MeV
S. N. Cramer and E. M. Oblow Sep. 1976 46 p refs Sponsored in part by the Defense Nuclear Agency, Washington, D. C.
(Contract W-7405-eng-26)
(ORNL/TM-5535) Avail: NTIS HC A03/MF A01

Monte Carlo calculations were performed to analyze an integral experiment on a liquid oxygen sample to determine the adequacy of the neutron scattering and gamma ray production data for oxygen. The experimental results included energy- and angular-dependent NE-213 detector count rates and secondary pulse height spectra for scattered neutrons and gamma rays. The sample was a spherical dewar of liquid oxygen pulsed with a 1- to 20-MeV neutron source. Pulse height data were unfolded to generate secondary neutron and gamma ray production spectra as a function of angle in broad incident neutron energy

bins. Analysis of all the reported data was based on multigroup Monte Carlo calculations using the MORSE code. Results indicate that the current ENDF/B-IV neutron and gamma ray production data for oxygen above 1 MeV appear to be in good order. The only major discrepancy uncovered was related to neutron scattering and gamma ray production from first level inelastic scattering interactions. ERA

N77-21936# Academy of Sciences (USSR), Moscow. Space Research Inst.

HELIUM ATOM IN THE SUPERINTENSE FIELD OF PULSARS

V. V. Burdjuzha and B. I. Zhilinsky 1976 19 p refs

(PR-284) Avail: NTIS HC A02/MF A01

Physical properties of matter significantly change in superintense magnetic fields (B approximately 1 G gauss). The location of the levels in the helium atom was estimated with logarithmic accuracy for longitudinal and transverse excitations relative to the magnetic field. The principal possibility was considered for detecting a helium line within the soft X-ray range from young pulsars. Arguments in favor of He4 ion outflow from pulsar surfaces are given. Author (ESA)

N77-21937# Queens Coll., Flushing, N.Y.

MOLECULAR DYNAMIC SHOCK WAVE STUDIES IN SOLIDS Final Report, 9 Apr. 1973 - 1 Jun. 1976

Arthur Paskin Jul. 1976 17 p refs

(Grants DA-ARO(D)-31-124-73-G127; DAHC04-74-G-0138; DAHC04-75-G-0139)

(AD-A032110; ARO-10943.1-E) Avail: NTIS HC A02/MF A01 CSCL 20/12

Molecular dynamics is the technique of using a computer to solve Newton's equations of motion for a number of interacting atoms. Computer programs were developed which simulated shock waves moving in three dimensional solids. The pressure, density, and temperature were obtained for a range of shock velocities. The results were used to confirm the Hugoniot equations for anisotropic, particulate systems. The simulations were in good agreement with experiment for iron and rare gas solids, despite their different structures and atomic interactions. Computer simulations and shock wave experiments were well described by an equation of state developed from the Hugoniot equations. The equation of state was used to explain the general linear behavior of shock velocity with particle velocity for a variety of solids. The equation of state further predicts the onset of a thermal catastrophe at very high shock velocities. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N77-21938*# Illinois Univ., Urbana.

OPTICAL LINE RADIATION FROM URANIUM PLASMAS Ph.D. Thesis

Edward Louis Maceda 1977 139 p refs

(Grant NsG-1063)

(NASA-CR-152735) Avail: NTIS HC A07/MF A01 CSCL 18H

The radiative energy current due to line radiation is calculated in a U 235 plasma over a temperature range of 5000 K to 8000 K. Also a variation in the neutron flux of 2 x 10 to the 12th power neutrons/ (sq cm-sec) to 2 x 10 to the 16th power neutrons/(sq cm-sec) is considered. The plasma forms a cylinder with a diameter and height of one meter. To calculate the radiative-energy current, a rate equation formalism is developed to solve for the atomic state densities along with a model for the energy levels in neutral and singly ionized uranium. Because the electron states in uranium lie below 5eV, recombination is the principle excitation mechanism. At and above 6000 K, inversions were found, and at all temperatures the line radiation at line center was greater than the corresponding black-body radiation. There are negligible differences in the radiative-energy current at 6000 K for variations in the neutron flux. The average opacity, which varied from 100 to 100,000 gm/sq cm, over the frequency range of line radiation is calculated. Author

N77-21939# California Univ., Livermore. Lawrence Livermore Lab.

MIRROR HYBRID REACTOR OPTIMIZATION STUDIES

D. J. Bender 9 Sep. 1976 9 p refs Presented at the Joint US-USSR Symp. on Fusion Fission Reactors, Livermore, Calif., 13-16 Jul. 1976

(Contract W-7405-eng-48)

(UCRL-78614; Conf-760733-4) Avail: NTIS HC A02/MF A01

A system model of the mirror hybrid reactor was developed. The major components of the model include: (1) the reactor description, (2) a capital cost analysis, (3) various fuel management schemes, and (4) an economic analysis that includes the hybrid plus its associated fission burner reactors. The results presented describe the optimization of the mirror hybrid reactor, the objective being to minimize the cost of electricity from the hybrid fission burner reactor complex. ERA

N77-21940# Brookhaven National Lab., Upton, N.Y. Dept. of Applied Science.

FUSION POWER SYSTEM: TECHNOLOGY AND ENGINEERING CONSIDERATIONS

J. A. Fillo 1976 40 p refs Presented at the IEEE Mini-Course in Fusion, Austin, Texas, 26-28 May 1976

(BNL-21721) Avail: NTIS HC A03/MF A01

Engineering concepts are discussed for the following topics: (1) blanket environment, (2) blanket materials, (3) tritium breeding, (4) heat removal problems, (5) materials selection for radiation shields, (6) afterheat, and (7) fusion blanket design. Author (ERA)

74 OPTICS

Includes light phenomena.

N77-21941* National Aeronautics and Space Administration. Pasadena Office, Calif.

UNIFORM VARIABLE LIGHT SOURCE Patent

Henry P. Squyres, inventor (to NASA) (JPL) Issued 16 Jan. 1973 7 p Filed 4 Dec. 1970 Sponsored by NASA

(NASA-Case-NPO-11429-1; US-Patent-3,711,701; US-Patent-Appl-SN-95189; US-Patent-Class-240-46.13; US-Patent-Class-240-41R; US-Patent-Class-240-41.35R; US-Patent-Class-356-236) Avail: US Patent Office CSCL 20F

A uniform stable light source comprising a special lamp with a built in reflector is described. The light projects stable and uniform luminous flux with unvarying spectral characteristics with a distribution temperature of about 3000 K. The uniform luminous flux flows into a conical cavity through an iris diaphragm whose diameter is controllable. A uniform light diffuser is positioned at the opposite end of the conical cavity. The level of luminance which is transmitted through the diffuser is controlled by controlling the diaphragm diameter.

Official Gazette of the U.S. Patent Office

N77-21942# Lockheed Missiles and Space Co., Palo Alto, Calif.

OPTICAL PROPERTIES OF Na3AlF6, PbF2, As2S3 COATINGS OBTAINED IN A HIGH AND ULTRAHIGH VACUUM

F. A. Korolev, A. Iu. Klement'eva, and S. I. Sagitov [1976] 4 p refs Transl. into ENGLISH from Vestnik., Moscow Univ., Fiz.-Astron. (Moscow), no. 5, 1976 p 626-628

Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The refractive indices of cryolite, lead fluoride, and arsenic trisulfide films obtained in 10 to the -5 and 10 to the -8 power mm Hg vacuum were determined. Coatings obtained in both a high and ultrahigh vacuum are characterized by high values of the refractive indices which are close to the values for bulk specimens. The results show that the passage to an ultrahigh vacuum causes a rise in the refractive index which is distinct for different substrances, and must be taken into account

in the practical realization of multilayer systems. The deposition rate and the substrate temperature must also be considered.
D.M.L.

N77-21943# Xonics, Inc., Van Nuys, Calif.
THEORETICAL STUDIES OF MATERIALS FOR HIGH-POWER INFRARED COATINGS Technical Report, 1 Jul. - 31 Dec. 1975
M. Sparks 31 Dec. 1975 347 p refs
(Contract DAHC15-73-C-0127; ARPA Order 1969)
(AD-A031948; TR-6) Avail: NTIS HC A15/MF A01 CSCL 20/12

Results and recommendations based on a survey of the coatings literature, on discussions with a number of investigators in the field, and on very simple analyses include the following: high-packing-density films should be vapor deposited using ultraclean deposition conditions including thorough baking of the entire system before deposition, high-purity single-crystal starting materials, special care in evaporation, state-of-the-art substrate preparation, and ultrahigh vacuum. Values of film absorptance A(f) per surface of A(f) = .0001 or absorption coefficient Beta(f) = 0.5/cm roughly, are desired. A major problem is that the values of Beta(f) usually are much greater than the corresponding bulk values beta(b). Material-selection guidelines, including a bulk absorption coefficient less than 0.5 and a value of the index of refraction in the required range, are developed and used to select the following 10.6 micrometer candidate materials: ThF4, NaF, BaF2, SrF2, NaCl, KCl, KGaF4, As2S3, As2Se3, ZnS, ZnSe, and TlL. A method of distinguishing between surface and bulk absorption in coatings by utilizing the fact that the electric field is zero on the surfaces of certain types of coatings and nonzero on others is proposed. GRA

N77-21944# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
RESONANT RAMAN EFFECT IN CRYSTALS AND LIQUIDS Final Report, 1 Apr. 1967 - 31 Aug. 1976
Richard K. Chang Oct. 1976 23 p refs
(Contracts N00014-67-A-0097-0005; N00014-75-C-0866)
(AD-A032185) Avail: NTIS HC A02/MF A01 CSCL 20/6

The first of two main objectives in this research was to further the basic understanding of resonance Raman scattering in solids and in gases. The following two new phenomena were observed: (1) resonant cancellation in the TO Raman cross section; and (2) selective resonant enhancement in the two-phonon cross section when the incident photon energy is near the indirect energy gap. The second objective was to design and develop an optical parallel-channel detection system for ultra-low light level spectroscopy. In addition to the obvious improvement in the signal-to-noise ratio and in the speed of acquiring data, spatially resolved gas concentration emerging from a nozzle can be mapped out by using laser Raman intensity from a one 1 msec ruby laser pulse. This introduces a totally new diagnostic tool for the study of gas and combustion dynamics. GRA

N77-21945# Naval Postgraduate School, Monterey, Calif.
LIFE CYCLE COSTING OF AN EMERGING TECHNOLOGY: THE FIBER OPTICS CASE Final Report, Mar. 1975 - Mar. 1976
Carl R. Jones, Ronald L. Johnson, Earle W. Knobloch, John M. McGrath, and Kenneth R. Michna Mar. 1976 444 p refs
(AD-A031839; NPS-55JS76031) Avail: NTIS HC A19/MF A01 CSCL 20/6

As significant technological advances in fiber optics and optical data transmission methods are being made, it is necessary to develop appropriate methods for estimating life cycle costs for alternative coaxial/twisted pair wire and optical fiber avionics. In Volume One, measures of effectiveness are suggested for each alternative system. An approach, which structures the technological and demand uncertainties of fiber optics, is developed through scenarios as a means of relating cost and effectiveness. It is suggested that Delphi and experience curve techniques be used in conjunction with ordered scenarios as a technological forecasting technique for estimation of life cycle costs of fiber optics. In addition, a review of the historical and technological background of fiber optics and their application to the Naval Electronics Laboratory Center (NELC) A-7 Airborne Light Optical Fiber Technology (ALOFT) Program is included.
GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N77-21946# Columbia Univ., New York. Plasma Lab.
NUMERICAL SOLUTION OF THE AXISYMMETRIC MAGNETOHYDRODYNAMIC EQUILIBRIUM EQUATION
Michael Foster Reusch 1976 148 p refs
(Contract E(11-1)-2456)
(COO-2456-36; Rept-69) Avail: NTIS HC A07/MF A01

The MHD equilibrium equation, for axisymmetric systems, as given by H. Grad and V. D. Shafranov, is described in cylindrical coordinates. The Dirichlet problem for this elliptic, mildly nonlinear, partial differential equation in a finite domain of solution is studied. Conditions for the existence and uniqueness of solutions to this problem are discussed. A lower bound on a parameter in the equation, below which bifurcation cannot occur, is derived. The behavior of a simple type of solution is analyzed. Several iteration methods for the numerical solution of the problem are presented and their convergence discussed. A fixed minimum constraint method for consistently finding several nonunique solutions to the problem is given. A one point approximation estimate is developed for the prediction of the occurrence of nonuniqueness and the number of nonunique solutions. A 1-D model problem, which is nonunique and exactly soluble, is discussed in detail. ERA

N77-21947# Los Alamos Scientific Lab., N. Mex.
PLASMA END-LOSS STUDIES ON SCYLLA I-C
K. F. McKenna and T. M. York Aug. 1976 27 p refs
(Contract W-7405-eng-36)
(LA-6412-MS) Avail: NTIS HC A03/MF A01

The development of a plasma loss orifice, well within the theta-pinch coil, is identified. The magnitude of the observed orifice is found to be in excellent agreement with that predicted from collisional MHD theories. The axially flowing plasma is well confined until it flows through the loss orifice. After passing through the orifice, rapid axial expansion is observed. An indication of the existence of inward traveling rarefaction waves is observed from the plasma midplane temperature data; an abrupt decrease in the plasma temperature at t approximately equal to 6.5 microseconds corresponds to the predicted time of arrival of rarefaction waves at the coil midplane. The plasma loss rate derived from the pressure data indicates an initial period t less than 4 microseconds of rapid particle loss followed by a period t greater than 4 microseconds gradual decay in the loss rate. This initial period of high loss rate is predicted from the MHD flow theories when the measured, time dependent plasma parameters are substituted into the analytical models. The loss rate determined from the end-on interferograms does not respond to the detailed structure of the plasma loss process. ERA

N77-21948# Los Alamos Scientific Lab., N. Mex.
RESONANT ABSORPTION IN PLASMA DENSITY PROFILES PRODUCED BY LASER HEATING
R. C. Malone and R. L. Morse Jul. 1976 5 p refs
(Contract W-7405-eng-36)
(LA-6446-MS) Avail: NTIS HC A02/MF A01

Efficiency and optimum angle of incidence of combined resonant and collisional absorption of laser are found by numerical simulation and an extension of ray tracing to be moderately insensitive to pulse width and peak power. ERA

N77-21949# Los Alamos Scientific Lab., N. Mex.
THEORETICAL RESULTS RELATING EXPERIMENTAL X-RAY SPECTRA TO THE NUMBER AND TOTAL ENERGY OF SUPRA THERMAL ELECTRONS IN LASER-HEATED PLASMAS
M. A. Stroscio Jul. 1976 5 p refs
(Contract W-7405-eng-36)
(LA-6465-MS) Avail: NTIS HC A02/MF A01

Formulas are derived which contain corrections to previous work, and relate the X-ray spectrum produced from a laser-heated plasma to the number and total energy of suprathermal electrons in the plasma. These formulas, together with experimental X-ray spectra, were used to determine the characteristics of the suprathermal electron distributions produced under differing experimental conditions. Specifically, the number and total energy of suprathermal electrons as well as the suprathermal electron temperature, alpha T/sub e/, are related to the experimental X-ray data. It is found that the suprathermal electron temperature is nearly independent of wavelength when the incident laser energy is constant. ERA

N77-21950# Los Alamos Scientific Lab., N. Mex.
PLASMA EXPERIMENTS ON THE STAGED THETA PINCH, THE IMPLOSION HEATING EXPERIMENT, AND SCYLLAC FEEDBACK-SECTOR EXPERIMENT
R. R. Bartsch, C. J. Buchenauer, E. L. Cantrell, J. N. Downing, B. L. Freeman, K. B. Freese, R. F. Gribble, I. Henins, A. R. Jacobson, F. C. Jahoda et al 1976 6 p refs
(Contract W-7405-eng-36)
(LA-UR-76-1843) Avail: NTIS HC A02/MF A01

Results of the Los Alamos theta-pinch program in three areas of investigation are summarized. In the staged theta pinch is investigated, results are reported on the effects of magnetic field amplitude and time history of plasma formation. Density, internal-magnetic-field and neutron measurements in the implosion heating experiment yield a consistent picture of the implosion which agrees with kinetic computations and with a simple dynamic model of the ions and magnetic piston. In the scyllac feedback-sector experiment, the 1 = 1, 0 equilibrium plasma parameters have been adjusted to accommodate the feedback stabilization system. With a uniform toroidal discharge tube, the m = 1 instability is feed back-stabilized in the vertical direction, and confinement in the toriidal direction is extended by feedback control. Results with a helical discharge tube are also reported. ERA

N77-21951# Los Alamos Scientific Lab., N. Mex.
CURRENT, TEMPERATURE, AND CONFINEMENT TIME SCALING IN TOROIDAL REVERSED-FIELD PINCH EXPERIMENTS ZT-I AND ZT-S
D. A. Baker, L. C. Burkhardt, J. N. DiMarco, A. Haberstich, R. L. Hagenson, R. B. Howell, H. J. Karr, and A. E. Schofield 1976 10 p refs Presented at 6th Intern. Conf. on Plasma Physics and Controlled Nuclear Fusion Res., Berchtesgaden, West Germany, 6 Oct. 1976
(Contract W-7405-eng-36)
(LA-UR-76-1875; Conf-761012-6; IAEA-CN-35/E-1) Avail: NTIS HC A02/MF A01

The scaling properties of a toroidal reversed-field Z pinch were investigated over a limited range by comparing two experiments having conducting walls and discharge tube minor diameters which differ by a factor of approximately 1.5. Both the confinement time of the plasma column and the electron temperature were found to increase about a factor of two with the increased minor diameter. Both the poloidal field diffusion and the decay of the toroidal reversed-field were significantly reduced with the larger tube diameter. These results support the hypothesis that the loss of stability later in the discharge is caused by diffusion induced deterioration of initially favorable plasma-field profiles to MHD unstable ones. This conclusion was verified by stability analysis of the magnetic fields profiles. Fusion reactor calculations show that small reactors are conceptually possible assuming good containment can be achieved for current densities greater than or equal to 20 MA/sq m. ERA

N77-21952# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
RECENT DEVELOPMENTS IN UNDERSTANDING THE PHYSICS OF LASER PRODUCED PLASMAS
B. Bezzerides, D. F. DuBois, D. W. Forslund, J. M. Kindel, K. Lee, and E. L. Lindman 1976 21 p refs Presented at the 6th IAEA Symp. on Plasma Physics and Controlled Nuclear Fusion Research, Berchtesgaden, West Germany, 6-13 Oct. 1976
(Contract W-7405-eng-36)
(LA-UR-76-1811; Conf-761012-8; IAEA-CN-35/F3) Avail: NTIS HC A02/MF A01

The absorption of intense laser light by a plasma is known to produce a high energy component of electrons. Even though the hot electron pressure may be larger than the cold background pressure, the background temperature can control the self-consistent profile modification. Since temperatures in high intensity experiments seem to be similar for CO2 and Nd glass lasers, the profile modification may be so severe for CO2 that orders of magnitude change in density can occur over microns, leading to a softened electron spectrum. However, the resulting equilibrium of laser pressure balancing plasma pressure is unstable even when flow is properly taken into account. Also briefly discussed are recent results for self-generated magnetic fields including important kinetic effects. ERA

N77-21953# Los Alamos Scientific Lab., N. Mex.
ANALYTIC AND NUMERICAL STUDIES OF SCYLLAC EQUILIBRIUM
D. C. Barnes, J. U. Brackbill, R. Y. Dagazian, J. P. Freidberg, W. Schneider, O. Betancourt, and P. Garabedian 1976 10 p refs Presented at 6th Intern. Conf. on Plasma Physics and Controlled Nuclear Fusion Res., Berchtesgaden, West Germany, 6 Oct. 1976
(Contract W-7405-eng-36)
(LA-UR-76-1882; Conf-761012-13; IAEA-CN-35/E-11) Avail: NTIS HC A02/MF A01

The results of both numerical and analytic studies of the Scyllac equilibria are presented. Analytic expansions are used to derive equilibrium equations appropriate to noncircular cross sections, and compute the stellarator fields which produce toroidal force balance. Numerical algorithms are used to solve both the equilibrium equations and the full system of dynamical equations in three dimensions. Numerical equilibria are found for both 1 = 1,0 and 1 = 1,2 systems. It is found that the stellarator fields which produce equilibria in the 1 = 1,0 system are larger for diffuse than for sharp boundary plasma profiles, and that the stability of the equilibria depends strongly on the harmonic content of the stellarator fields. ERA

N77-21954# Los Alamos Scientific Lab., N. Mex.
KINETIC BEHAVIOR OF HIGH BETA PLASMAS
J. P. Freidberg, R. A. Gerwin, D. W. Hewett, H. R. Lewis, C. W. Nielson, A. G. Sgro, L. Turner, and D. Winske 1976 9 p refs Presented at 6th Intern. Conf. on Plasma Physics and Controlled Nuclear Fusion Res., Berchtesgaden, West Germany, 6 Oct. 1976
(Contract W-7405-eng-36)
(LA-UR-76-1881; Conf-761012-12) Avail: NTIS HC A02/MF A01

The study of the kinetic behavior of high beta plasma has centered around two main problem areas. The first of these is the investigation of anomalous transport during the fast implosion phase and slow post-implosion phase of high beta pinches. The second concerns the calculation of finite ion gyroradius effects on unstable MHD modes in diffuse high beta pinches. The results of these studies are summarized. ERA

N77-21955# California Univ., Livermore. Lawrence Livermore Lab.
DESIGN CONSIDERATIONS IN INERTIALLY-CONFINED FUSION REACTORS
Jack Hovingh Aug. 1976 53 p refs
(Contract W-7405-eng-48)
(UCRL-78499) Avail: NTIS HC A04/MF A01

The effects of short time pulses of energetic particles and waves typical of inertially-confined thermonuclear reactions on the first wall, blanket, and shield of conceptual reactors are discussed. Several reactor designs are presented which attempt to cope with the various problems from the microexplosion debris. Fusion-fission hybrid reactors are also discussed. Emphasis is placed on the first-wall problems of laser-initiated, inertially confined fusion reactors using the deuterium-tritium fuel cycle. ERA

N77-21956# Los Alamos Scientific Lab., N. Mex.
PULSED ENERGY STORAGE IN FUSION DEVICES
K. I. Thomossen, J. D. Rogers, and F. L. Ribe 1976 11 p refs Presented at 6th Intern. Conf. on Plasma Phys. and Controlled Nucl. 6 Oct. 1976

(Contract W-7405-eng-36)
(LA-UR-76-1837; Conf-761012-9) Avail: NTIS HC A02/MF A01

Research and development on pulsed energy technologies, primarily for pulsed high-beta fusion systems, are described. Systems studies at Los Alamos and elsewhere have served to define these required technologies, which include fast discharging homopolar machines, pulsed superconducting coils, and the associated switching technology. Programs at the Los Alamos Scientific Laboratory, Westinghouse, and The University of Texas are also described. ERA

N77-21957# Oak Ridge National Lab., Tenn.
CALCULATION OF MAGNETIC FIELD RIPPLE EFFECTS IN CIRCULAR AND NONCIRCULAR TOKAMAKS
N. A. Uckan, T. Uckan, and J. R. Moore Sep. 1976 34 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5603) Avail: NTIS HC A03/MF A01

A computer model (RIPPLE) was developed to examine the magnetic field ripple effects on plasma transport and on scaling in circular and noncircular Tokamaks. Calculations include the radial and poloidal variation in the magnitude of the field ripple. Two main magnetic field computer programs were used to calculate the magnetic field due to current flowing in a coil of finite rectangular cross section: BFULT for tori of circular coils, and BOVAL for tori of noncircular coils. The relevant results and criteria for the choice of the number of toroidal field coils for a given Tokamak configuration are presented. ERA

N77-21958# Ecole Polytechnique Federale de Lausanne (Switzerland).
ANOMALOUS SPATIAL DEPLETION OF LOWER-HYBRID CONE THROUGH PARAMETRIC DECAY
Liu Chen (Princeton Univ., N. J.) and R. L. Berger (Princeton Univ., N. J.) Jul. 1976 16 p refs Sponsored in part by the Swiss Natl. Science Foundation
(Contract E(11-1)-3073)
(LRP-110/76) Avail: NTIS HC A02/MF A01

Analytic solutions for the envelope structures of two nonlinearly coupled lower-hybrid waves propagating along their respective cone trajectories are obtained. The coupling occurs through induced scatterings by particles. The results indicate anomalous spatial pump depletion. Implications to plasma heating are also discussed. ERA

N77-21959# Energy Research and Development Administration, Washington, D.C.
DESIGN-TECHNOLOGICAL ASPECTS OF DESIGNING THE VACUUM SYSTEM OF THE DEMONSTRATION TOKAMAK THERMONUCLEAR REACTOR
V. N. Odintsov, G. L. Saksaganskii, and D. V. Serebrennikov 1976 26 p refs Transl. into ENGLISH of Russian preprint A-0295 (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad), 1976 26 p
(ERDA-TR-181) Avail: NTIS HC A03/MF A01

The structure of the DTTR vacuum system is described, and its basic parameters are given. Vacuum chamber requirements are formulated, and the principles of its construction are given. Thermal regimes of certain modifications of the protective screens are examined. Balance equations of the gas fluxes in the discharge chamber at different stages of the operating cycle are analyzed. The expediency of modular construction of the reactor pumpdown system is demonstrated. ERA

N77-21960# California Univ., Livermore. Lawrence Livermore Lab.
THEORETICAL EXPLANATION OF PRESENT MIRROR EXPERIMENTS AND LINEAR STABILITY OF LARGER SCALED MACHINES
H. L. Berk, D. E. Baldwin, T. A. Cutler, L. L. Lodestro, N. Maron, L. D. Pearlstein, T. D. Rognlien, J. J. Stewart, and D. C. Watson 27 Jul. 1976 13 p refs Presented at the 6th Intern. Conf. on Plasma Physics and Controlled Nuclear Fusion Research, Berchtesgaden, West Germany, 6-13 Oct. 1976
(Contract W-7405-eng-48)
(UCRL-78125; Conf-761012-7) Avail: NTIS HC A02/MF A01

A quasilinear model for the evolution of the 2XIIB mirror experiment is presented and shown to reproduce the time evolution of the experiment. From quasilinear theory it follows that the energy lifetime is the Spitzer electron drag time for T/sub e/ approximately less than 0.1T/sub i/. By computing the stability boundary of the DCLC mode, with warm plasma stabilization, the electron temperature is predicted as a function of radial scale length. In addition, the effect of finite length corrections to the Alfven cyclotron mode is assessed. ERA

N77-21961# California Univ., Livermore. Lawrence Livermore Lab.
NEW FIELD EQUATIONS
Edward P. Lee 4 Oct. 1976 22 p
(Contracts W-7405-eng-48; NAONR-11-76)
(UCID-17286) Avail: NTIS HC A02/MF A01

Field equations solved by the beam propagation code EMPULSE are presented, including their derivation from the underlying Maxwell equations. The code treats a highly relativistic charge particle beam propagating in a gas-plasma medium characterized by scalar conductivity. ERA

N77-21962# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Physics.
PARAMETRIC INSTABILITIES IN MAGNETIZED PLASMAS
Heiji Sanuki and George Schmidt Feb. 1976 18 p refs
(Contract AT(11-1)-3004)
(COO-3004-14) Avail: NTIS HC A02/MF A01

A theory is developed for parametric instabilities driven by a finite wave number general pump wave. This formalism is applied to describe lower hybrid decay into electromagnetic modes. A separate treatment is given for the all electrostatic wave case using the physically more transparent particle drift equations. In particular, the purely growing mode is studied. ERA

N77-21963# Oak Ridge National Lab., Tenn.
TRANSPORT AND SCALING IN THE ELMO BUMPY TORUS (EBT)
C. L. Hedrick, R. A. Dandl, J. A. Cobble, R. A. Dory, H. O. Eason, E. G. Harris (Tenn. Univ., Knoxville), G. R. Haste, H. Ikegami (Nagoya Univ., Japan), E. F. Jaeger, and N. H. Lazar 1976 9 p refs presented at the 6th Intern. Conf. on Plasma Physics and controlled Nucl. Fusion Res., Berchtesgaden, West Ger., 6 Oct. 1976
(Contract W-7405-eng-26)
(IAEA-CN-35/D7; Conf-761012-3) Avail: NTIS HC A02/MF A01

In the ELMO Bumpy Torus (EBT), a macroscopically stable regime of operation is expected theoretically and observed experimentally. The power level for microwave bulk heating recently was doubled to 60 kW, and the resulting plasma parameters scaled encouragingly with this increase in microwave power (e.g., T/sub i/ greater than or equal to 130 eV). The plasma beta for the higher microwave power is approximately 1%; this is still well below the theoretical macroscopic magnetohydrodynamic (MHD) instability limit: a plasma beta comparable to the beta of the hot electron annuli can be stably confined provided a minimum exists in the magnetic field. A radially resolved fluid transport code, based upon refined neoclassical coefficients, yields results which are in reasonable agreement with earlier and recent experimental observations. ERA

N77-21964# Princeton Univ., N.J. Plasma Physics Lab.
TRANSPORT OF PLASMA ACROSS A BRAIDED MAGNETIC FIELD
T. H. Stix Oct. 1976 38 p refs
(Contract E(11-1)-3073)
(PPPL-1299) Avail: NTIS HC A03/MF A01

Transport rates are calculated for a plasma immersed in a region through which magnetic lines of force meander in a stochastic fashion and in which the magnetic surfaces are destroyed. Such a magnetic condition, termed magnetic braiding, may be brought about by asymmetric magnetic perturbations, perhaps quite weak, which typically produce overlap of two sets of magnetic islands. Plasma transport is calculated for this environment, using both a fluid and a kinetic drift model. Insertion of a Bhatnager-Gross-Krook collision term shows the diffusion

rate is unaffected by weak collisions. Diffusion due to magnetic braiding is of interest for tokamaks, particularly with respect to enhanced electron heat transport, enhanced current penetration, plasma disruption, and internal sawtooth oscillations. ERA

N77-21965# Princeton Univ., N.J. Plasma Physics Lab.
TRANSPORT OF A MULTIPLE ION SPECIES PLASMA IN THE PFIRSH-SCHLUTER REGIME
S. P. Hirshman Oct. 1976 48 p refs
(Contract E(11-1)-3073)
(PPPL-1291) Avail: NTIS HC A03/MF A01

The classical parallel friction coefficients, which relate the collisional friction forces to the flow of particles and heat along the magnetic field, are calculated for a multiple ion species plasma. In the short mean free path regime, the neoclassical Pfirsch-Schlueter transport coefficients for a toroidally confined multispecies plasma are computed in terms of the classical friction coefficients. The dependent of the neoclassical cross-field transport on the equilibration of the parallel ion temperature profiles is determined. ERA

N77-21966# Princeton Univ., N.J. Plasma Physics Lab.
PROPOSAL FOR MEASURING THE LOCAL ION DISTRIBUTION FUNCTION AND THE NEUTRAL DENSITY PROFILE IN TOROIDAL PLASMAS
M. Brusati Aug. 1976 12 p refs
(Contract E(11-1)-3073)
(MATT-1273) Avail: NTIS HC A02/MF A01

A method is proposed for measuring the local ion energy distribution function and the neutral density profile through the analysis of charge-exchange fast neutral spectra, employing an active diagnostic for local ion temperature in large Tokamaks. ERA

N77-21967# California Univ., Livermore. Lawrence Livermore Lab.
MIRROR MACHINE REACTORS
G. A. Carlson and R. W. Moir 1976 20 p refs Presented at 2d ANS Topical Meeting on the Technol. of Controlled Nucl. Fusion, Richland, Wash., 21 Sep. 1976
(Contract W-7405-eng-48)
(UCRL-78148; Conf-760935-6) Avail: NTIS HC A02/MF A01

Mirror reactor conceptual design studies are described. Considered in detail is the design of standard Yin-Yang fusion power reactors with classical and enhanced confinement. It is shown that to be economically competitive with estimates for other future energy sources, mirror reactors require a considerable increase in Q, or major design simplifications, or preferably both. These improvements may require a departure from the standard configuration. Two attractive possibilities, both of which would use much of the same physics and technology as the standard mirror, are the field reversed mirror and the end-stoppered mirror. ERA

N77-21968# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
MEASUREMENT OF THE DAMPING CONSTANTS OF NI LINES IN THE WAVELENGTH RANGE BETWEEN 1100 AND 1800 ANGSTROM [MESSUNG DER DAEMPFUNGSKONSTANTEN VON NI-LINIEN IM WELLENLAENGENBEREICH 1100 BIS 1800 A]
Elmar Cullmann Aug. 1976 46 p refs In GERMAN
(MPI-PAE/Extraterr-125) Avail: NTIS HC A03/MF A01

Measurements are reported of NI lines in the 1,100 to 1,800 angstrom range, from which the damping constants of these quadratic Stark effect broadband lines can be determined. The constants are needed in addition to oscillator strengths for calculation of radiation transport in plasmas. Spectroscopic emission measurements were carried out using a special cascade arc discharge as a light source, the plasma of which can be considered thermal. The damping constants result from direct absolute intensity measurements in the flanks of the NI lines and from the growth curve constructed for each separate line assuming known occupation number of the lower state, oscillator strength, and form of the line profile. ESA

N77-21969# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
VORTEX FLOW IN A TORUS. A METHOD FOR ARC STABILIZATION Ph.D. Thesis - Utrecht Univ.
R. W. Polman Aug. 1976 115 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
(Rept-76-97) Avail: NTIS HC A06/MF A01

Experiments on ring vortices inside a torus and experiments on semi-toroidal arcs stabilized by such vortices are described. The studies were performed in two separate devices. One of the toroidal vortex chambers, Cogion, with R = 0.45 m and r = 0.10 m permits the establishment of a gas flow only. In the other device, Tovorex, with R = 0.19 m and r = 0.04 m, it is also possible to draw a semi-toroidal arc. In both devices, the toroidally symmetric ring vortices are obtained by poloidal injection and exhaust of gas through slits running in toroidal direction and extending over the whole circumference. The arcs are drawn between two tungsten electrodes in the core of the rotating flow. The arc can be given an adjustable length of 1.0 m maximum, which only covers a part of the 1.2 m long circular vortex axis; therefore the term semi-toroidal arc is used. The rotation of the gas forces the discharge into the core of the vortex, thus preventing it from coming into contact with the metal wall. Author (ESA)

N77-21970# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
OHMIC PLASMA HEATING BY MAGNETIC FIELD-ALIGNED CURRENTS IN AN INTERNAL RING CONFIGURATION
D. Ohlsson Jun. 1976 23 p refs
(TRITA-EPP-76-15) Avail: NTIS HC A02/MF A01

Ohmic heating of a plasma confined by a poloidal magnetic field and impermeable to neutral gas was investigated. The time dependent macroscopic fluid equations were solved numerically by using a combination of an implicit and an explicit method. The plasma loss mechanisms were assumed to be of classical origin but anomalous effects could be simulated by introducing certain numerical factors. The heat losses along the magnetic field lines due to incomplete magnetic shielding of the internal ring supports were considered in terms of a single-particle model. The possibilities of a pinching of the heating current resulting in a thermal instability are discussed, as well as various stabilizing mechanisms. Author (ESA)

N77-21971# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
STABILITY OF PLANE PARALLEL FLOWS IN A MAGNETIZED PLASMA
M. Dobrowolny Nov. 1976 28 p refs
(LPS-76-29) Avail: NTIS HC A03/MF A01

An investigation of the problem of stability of plane parallel flows in a magnetized plasma, based on magnetohydrodynamics equations, is presented. The corresponding eigenvalue problem, for incompressible velocity perturbations, is solved numerically, using continuous profiles for both plasma density and velocity at equilibrium. The relevance of the results to studies of MHD waves observed in the solar wind is assessed. Author (ESA)

N77-21972# Colorado Univ., Boulder. Dept. of Astro-Geophysics.
LINEAR INHOMOGENEOUS THEORY OF Co2-ENHANCED LANGMUIR TURBULENCE Final Report
Martin V. Goldman 31 Jul. 1976 25 p
(Contract F44620-73-C-0003; AF Proj. 9751)
(AD-A031288; CU-1019-A1; AFOSR-76-1116TR-Attach-1)
Avail: NTIS HC A02/MF A01 CSCL 20/9

Langmuir turbulence and electron density in plasma scattering are described. Kinematics of plasma wave convection effects are computed. I.M.

N77-21973# Naval Research Lab., Washington, D. C.
A DYNAMICAL MODEL FOR MAGNETIC SIGNAL INTERPRETATION IN RELATIVISTIC ELECTRON BEAM HEATED PLASMAS
K. R. Chu and R. W. Clark Oct. 1976 23 p refs
(AD-A032047; NRL-MR-3386) Avail: NTIS HC A02/MF A01 CSCL 20/5

A dynamical model is developed to infer the plasma energy

from local and global magnetic field measurements. Physical processes involved are macroscopic and observable. Scaling laws provide further checks. This model, when applicable, should be employed to estimate the plasma energy in rapidly pulsed heating experiments, where static pressure balance models have been commonly used. Author (GRA)

N77-21974# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.

THERMOLUMINESCENT DETECTOR SPECTRAL ANALYSIS ON THE RETRO-FOCUS SIMULATOR Interim Report

G. Marshall Molen, Kenneth W. Paschen, Robert H. Vandre, and Catherine T. Young 22 Oct. 1976 30 p refs

(Contract F04701-76-C-0077)

(AD-A032116; TR-0077(2250-20)-2; SAMSO-TR-76-215) Avail: NTIS HC A03/MF A01 CSCL 20/8

A spectral analysis of the x-ray fluence from the Aerospace Mark IV plasma focus operated in the retro-focus mode is discussed. A dosimeter fixture with 11 thermoluminescent detectors was used to resolve the spectrum in the range of 1 to 1,000 keV. Two x-ray converter materials, tantalum and aluminum, were studied to demonstrate spectral tailoring. The actual spectra were unfolded from experimental data by using an operator-implemented computer routine. An effective softening of the spectrum caused by the K-line emission at 1.5 keV was observed when the aluminum converter was used. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N77-21975*# RCA Labs., Princeton, N.J.

ROOM-TEMPERATURE-OPERATION VISIBLE-EMISSION SEMICONDUCTOR DIODE LASERS Final Report, 2 Dec. 1975 - 2 Nov. 1976

I. Ladany, H. Kressel, and C. J. Nuese Apr. 1977 67 p refs

(Contract NAS1-13739)

(NASA-CR-2823; PRRL-76-CR-16) Avail: NTIS HC A04/MF A01 CSCL 20E

There were two main approaches taken to develop shorter wavelength lasers. (1) Based on (AlGa)As and liquid-phase epitaxy, significant new results were obtained: Properties of these laser diodes (power output, spectra, and beam patterns), materials considerations, laser theory, and growth problems are discussed. The design of (AlGa)As layers is discussed from the vertical point of view, and various design curves are given. Horizontal structural requirements are also discussed. Experimental results from measurements done as a function of hydrostatic pressure are correlated with other results. (2) The first heterojunction laser structures using GaAs sub l-x P sub x and In sub y Ga sub l-y P at compositions, where the lattice constants are matched, were grown using vapor-phase growth technology and are described in detail, including experimental device results. Threshold current densities from 3,000 to 5,000 A per sq cm. and emission wavelengths from 6,520 A to 6,640 A were obtained at 77 K. The limiting factor in these devices is nonradiative recombination at the heterojunctions. Life tests on facet-coated (AlGa)As CW diodes are reported. Author

N77-21976# General Electric Co., St. Petersburg, Fla. Dept. of Neutron Devices.

CERAMIC FLAT PACK ENCLOSURES FOR PRECISION QUARTZ CRYSTAL UNITS

R. Donald Peters 1 Sep. 1976 24 p refs

(Contract E(29-2)-0656)

(GEPP-246) Avail: NTIS HC A02/MF A01

Techniques in the design and development of ceramic flat pack enclosures for 20-MHz and 5-MHz precision crystal units are described. A microcircuit enclosure for the 5-MHz crystal units consists of an octagonal Al2O3 laminated ceramic frame with four conductive feedthroughs. Metallized ceramic ledges are provided internally for thermocompression bonding of resonator mounting clips and on the outside for attachment of electrical leads. Single layer Al2O3 ceramic covers are bonded to the frame after resonator plating. The 20-MHz ceramic enclosure is a square frame with similar covers and feedthroughs. Nickel electrobonding provides a low stress conductive bond between the gold-chromium resonator contacts and thin preformed nickel clips. Three enclosure sealing techniques are described: (1) gold-gold diffusion bonding; (2) bonding of alumina to aluminum; and (3) tin-gold reaction braze. ERA

N77-21977# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

ELECTRONIC STRUCTURE AND PROPERTIES OF MAGNETIC DEFECTS IN CoSUB(1+x)AlSUB(1-x) AND FeSUB(1+x)AlSUB(1-x) ALLOYS Ph.D. Thesis - Paris 6 Univ.

Daniel Abbe Jul. 1976 73 p refs In FRENCH; ENGLISH summary

(ONERA-NT-1976-5) Avail: NTIS HC A04/MF A01

The study of CoAl and FeAl compounds has been developed along two directions. It is shown that results on magnetic susceptibility and specific heat at low temperature on (NiCo)Al and (CoFe)Al ternary alloys are in good agreement with band calculations obtained by various authors. Results on magnetization and specific heat under field at low temperature on non-stoichiometric compounds show clearly the importance of the nearest neighbor effects. In the case of CoAl, the isolated cobalt atoms substituting aluminum are characterized by a Kondo behavior, and, for FeAl, the isolated extra iron atoms are magnetic and polarize the matrix. Moreover, for the two compounds, clusters of higher order play a considerable part in the magnetic properties: for CoAl, these clusters also seem to be characterized by a Kondo behavior; for FeAl, these clusters, whose moment is higher than in the case of isolated atoms, could be constituted of excess pairs of iron atoms. Author (ESA)

N77-21978# California Univ., Berkeley. Dept. of Physics.

SUPERCONDUCTING DEVICES FOR MILLIMETER AND SUBMILLIMETER WAVELENGTHS Technical Report, 1 Feb. 1976 - 31 Jan. 1977

P. L. Richards Oct. 1976 18 p refs Presented at Intern. Conf. on Quantum Interference Devices, Berlin, 4-8 Oct. 1976

(Contract N00014-75-C-0496)

(AD-A031849) Avail: NTIS HC A02/MF A01 CSCL 09/5

Josephson junctions are highly nonlinear and respond up to infrared frequencies. A wide variety of high frequency applications have been explored. In addition, several high frequency superconducting devices are being developed which do not use the Josephson effect. These include a superconducting version of the Schottky barrier diode for use as a heterodyne mixer and a video detector, and also a composite superconducting bolometer. In this review, the state of development of superconducting mixers, detectors, and parametric amplifiers at microwave, millimeter, and submillimeter wavelengths is discussed. Emphasis will be placed on developments which have taken place since 1974 when a previous review was circulated. GRA

N77-21979# Colorado Univ., Boulder.

A MODEL FOR THE PREDICTION OF SEMICONDUCTOR HETEROJUNCTION DISCONTINUITIES USING BULK BAND STRUCTURES Ph.D. Thesis

William Robert Frensley Sep. 1976 151 p refs

(Grant DAHC04-74-G-0114)

(AD-A032078; ARO-12061.4-EL) Avail: NTIS HC A08/MF A01 CSCL 20/12

The problem of theoretically predicting the energy band discontinuities at a semiconductor heterojunction is studied in a simple model. The bulk band structures and their relationship to the periodic electrostatic potential are calculated by a self-consistent pseudopotential technique. A simple matching scheme determines the lineup of the electrostatic potentials at the interface, and this determines the band lineup. The predicted

band lineups are in good qualitative agreement with experimentally known lineups, and the model is applied to the prediction of discontinuities for heterojunctions for which no data are available. Author (GRA)

N77-21980# Dayton Univ., Ohio. Dept. of Physics.
IDENTIFICATION OF DEFECTS IN COMPOUND SEMICONDUCTORS Final Report, 1 Jul. 1971 - 31 Mar. 1976
David C. Look, Jon M. Meese, Marshall M. Kreitman, and Jose C. Manthuruthil Oct. 1976 218 p refs
(Contract F33615-71-C-1877)
(AD-A032128; AFAL-TR-76-139) Avail: NTIS HC A10/MF A01 CSCL 20/12

Radiation-damaged, ion-implanted, doped, and as-grown semiconducting materials, including CdS, CdSe, CdTe, CdO, ZnS, ZnSe, ZnTe, ZnO, HgS, CuInS2, In2Te3, GaAs, GaAlAs, Si, and Ge, have been examined by photoluminescence, cathodoluminescence, optical absorption, thermal conductivity, magnetic susceptibility, Hall effect, photoconductivity, photomagnetoelectric effect, and nuclear magnetic resonance techniques. Author (GRA)

N77-21981# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
RESEARCH ON CRYSTAL GROWTH AND THE OPTICAL AND MAGNETO-OPTICAL PROPERTIES OF SEMICONDUCTORS Final Report, 1 Jul. 1964 - 30 Jun. 1974
Cole W. Litton Aug. 1976 82 p
(AD-A031832; AFAL-TR-76-147) Avail: NTIS HC A05/MF A01 CSCL 20/12

This report covers the research performed during the period from 1 July 1964 to 30 June 1974 by scientists from the Group 'Research on Crystal Growth and the Optical and Magneto-Optical Properties of Semiconductors' and was performed in the Solid State Physics Research Laboratory of the Aerospace Research Laboratories Wright-Patterson Air Force Base, Ohio, under Project 7885, Task 01. Some highlights and significant achievements of the research program in the areas of crystal growth, optical and magneto-optical properties of II-VI and III-V semiconductors, and device oriented research are discussed qualitatively. The crystal growth program is discussed in terms of defect production and purification in the II-VI semiconducting compounds, particularly CdS, CdSe, ZnS, ZnO, ZnSe, ZnTe, CdTe and alpha-HgS. The optical and magneto-optical properties of the II-VI compounds are discussed either with respect to characterization of their fundamental optical and magneto-optical parameters, or to characterization of the defect and impurity structure of these materials. Experimental values of some of the more important physical constants of these materials, such as bandgaps, electron and hole effective masses and g-factors, exciton parameters, dielectric constants and refractive indices, are summarized in the various tables of the report. GRA

N77-21982# Wisconsin Univ., Madison. Mathematics Research Center.
MAGNETIC FLUX ANNIHILATION IN A LARGE JOSEPHSON JUNCTION
Alwyn C. Scott Jul. 1976 66 p refs
(Contract DAAG29-75-C-0024; Grant NSF ENG-75-08492)
(AD-A031942; MRC-TSR-1649) Avail: NTIS HC A04/MF A01 CSCL 20/12

Recent developments in the theory of the sine-Gordon equation are used to analyze the appearance of a displaced linear branch in the voltampere characteristic of a large Josephson junction. Internally the junction is divided into a flux annihilation domain near the center and flux flow domains near the edges. The displaced linear branch is experimental evidence for the existence of flux flow domains. In the flux annihilation domain, an ac voltage component is induced by the continuous formation and decay of sine-Gordon breathers. Whitham's nonlinear WKB method is used to analyze the flux flow domains while the inverse scattering transform method is used as a qualitative guide to the study of breather formation in the flux annihilation domain. Author (GRA)

N77-21983# Watervliet Arsenal, N.Y.
CRYSTALS UNDER STRAIN: SYMMETRY CONSIDERATIONS
D. M. Gray Oct. 1976 54 p refs
(AD-A031846; WVT-TR-76039) Avail: NTIS HC A04/MF A01 CSCL 20/2

The application of Group Theory to the calculation of electronic energy shifts in ordered crystals under strain considerably simplifies the computational effort and presentation of results. A perturbation approach to such calculation is outlined. To make full use of Group Theory arbitrary strains must first be decomposed into component strains, and the point groups associated with the particular component strains must be known. This report indicates how one determines these associations and describes the simplifying relations which exist due to symmetry alone. Specific examples for deformations of cubic, hexagonal, and tetragonal crystals are given. Author (GRA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

No abstracts in this category.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N77-21984 Accession number not used.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N77-21985*# Ross (S.) and Co., Boston, Mass.
IMPLEMENTATION AND TESTING OF A NEIGHBORHOOD OFFICE CENTER (NOC) AND INTEGRATION OF THE NOC WITH AN ADMINISTRATIVE CORRESPONDENCE MANAGEMENT INFORMATION SYSTEM Final Report
7 Feb. 1977 42 p ref
(Contract NASw-2889)
(NASA-CR-152645) Avail: NTIS HC A03/MF A01 CSCL 05A

The application of telecommunications and telecomputing was investigated as a means of reducing NASA's consumption of natural resources and the proliferation of paper copies of correspondence. The feasibility, operational advantages, and limitations of decentralized (remote) neighborhood offices (NOC)

linked through an electronic network are demonstrated. These offices are joined to a management information system for correspondence tracking, and to an administrative office center service based on the use of magnetic medium word processing typewriters which handle the daily typing load. In connection with an augmented teleconference network, a uniform means is provided for creating, storing, and retrieving administrative documents, records, and data, while simultaneously permitting users of the system to track their status. Information will be transferred without using paper - merely through digital electronic communication and display, as a step toward the establishment of an agency-wide electronic mail system. Author

N77-21986# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN ANALYSIS OF EXISTING ETHICAL GUIDELINES AND THE DEVELOPMENT OF A PROPOSED CODE OF ETHICS FOR MANAGERS M.S. Thesis

Randolph K. Adams Sep. 1976 181 p refs
(AD-A032387; GSM/SM/76S-1) Avail: NTIS HC A09/MF A01 CSCL 05/1

Recent disclosures of questionable behavior on the part of leaders of many American institutions have left people disillusioned with professions which once commanded deep respect. The primary objective of this study is to develop a proposed universal code of ethics for managers in response to public demand for a clearer picture of the ethical responsibilities of today's leaders. After reviewing current literature, the author develops the nature, need, widespread use, value, and key contents of ethical codes. Information of currently existing ethical codes, creeds, and related policy was solicited from presidents of 201 large industries selected from the 1975 'Fortune 500' listing. Inquiries were made to executive directors of 24 professional associations, to 44 small industries, and to the ethics committees of both the House of Representatives and the Senate. The proposed Code of Ethics for Professional Managers which this thesis develops is modeled on the information gathered regarding contents, format, scope of coverage, and criteria contained in the aggregation of collected codes. Responsibilities of a manager are classified and addressed in terms of key interest groups as follow: customers, investors, employees, employer, the public, and professional associates. The proposed code is presented as a separate unit within the thesis so it may be extracted for review, discussion, and use. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N77-21987# British Library Lending Div., Boston Spa (England).

THE SHEFFIELD MANPOWER PROJECT: A SURVEY OF STAFFING REQUIREMENTS FOR LIBRARIANSHIP AND INFORMATION WORK Final Report

R. Sergean, J. R. McKay, and C. M. Corkhill 1976 497 p refs
(BLL-BLRD-5302-(2113.56F); Publ-8) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

The questionnaire is an attempt to devise a standard means of collecting job information in a form which will permit coverage of, and comparison within, a wide and varied population, this information being provided by jobholders themselves. Description is in terms of the behavior called for by the work, and of varying factors in the working environment to which the jobholder must adapt, rather than purely in terms of the job's technical or library characteristics. At the same time, the questionnaire examines the characteristics of the jobholder and how far these match up with those called for by the job. Author

N77-21988# California Univ., Berkeley. Lawrence Berkeley Lab.

INTERACTIVE MATRIX DISPLAYS AND MANAGEMENT INFORMATION REPORTING: A FEASIBILITY ASSESSMENT Ph.D. Thesis

Bernard Kitous Jun. 1976 291 p refs
(Contract W-7405-eng-48)
(LBL-5310) Avail: NTIS HC A13/MF A01

Graphic methods for the display of numerical management information were investigated. A specific class of graphic representations, called matrix displays, is defined as the direct mapping of data tables into two-dimensional graphic matrices. Each data item is represented by variations in the sizes of dots or bars, or in the density of grey shadings. A three-step research methodology is chosen to assess the feasibility of matrix displays for management information reporting: findings in other fields relevant to the thesis of feasibility are identified, a theory of the usefulness of matrix displays and a corresponding model are proposed, and the practical utility of the matrix display model is assessed in a real-life managerial environment. Two different fields of research provide strong evidence that matrix displays are technically feasible, experimental results on human visual performance and multidimensional analytic research. Author

N77-21989# Oak Ridge National Lab., Tenn.

REGIONAL INFORMATION GROUP (RIG). ENERGY, ENVIRONMENTAL, AND SOCIOECONOMIC DATA BASES AND ASSOCIATED SOFTWARE AT OAK RIDGE NATIONAL LABORATORY

A. S. Loebl, N. S. Malthouse, D. B. Shonka, M. C. Ogle, and M. L. Johnson Oct. 1976 140 p
(Contract W-7405-eng-26)
(ORNL/TM-5600) Avail: NTIS HC A07/MF A01

The contents and organization of a machine readable data base are described. Documentation of the energy, environmental, and socioeconomic data bases is provided along with associated software. ERA

N77-21990# National Physical Lab., Teddington (England). Div. of Computer Science.

COMPUTER RETRIEVAL OF INCORRECTLY SPELLED SURNAMES

E. R. Dymott Oct. 1976 37 p refs Sponsored by Computer Systems and Electron. Requirements Board
(NPL-Com-83) Avail: NTIS HC A03/MF A01

A system is described for retrieving surnames from a file when auditory confusion may have led to incorrect spelling. The system aims to retrieve a high proportion of the plausible names while accessing an acceptably small portion of the total file. Detailed comparison with each one retrieved is made thus giving each a figure of merit which provides a means of reducing the retrieval to names which are a likely match. Author (ESA)

N77-21991# Data for Development International Association, Marseille (France).

INFORMATION SYSTEMS IN GOVERNMENT: 1: DATA GATHERING AND ORGANIZATION AT CENTRAL LEVEL

J. Barthelemy, J.-P. Greiveldinger, K. Jones, G. Nathan, O. Salomonsson, and Michel Dappe 1976 208 p 3 Vol.
(PB-261301/6; DFD-1976:1) Avail: NTIS HC A10/MF A01; HC also avail. in set of 3 reports PC E10, PB-261300-SET CSCL 05B

The information network concept is introduced by an overall consideration of the statistical and administrative sources of data. Demand-supply relationships within the network are examined. Problems and hypotheses surrounding the gathering and organization of data are presented, with particular emphasis on the demand for integration within the network. Reports of the case studies conducted in Norway, Israel, Belgium, and France are included. Against the background of the political and institutional environment for each country visited, the existing features of the data network and the characteristics of the available statistical and administrative data are described, with an analysis of observed problems of their organization in each country. GRA

N77-21992# Data for Development International Association, Marseille (France).

INFORMATION SYSTEMS IN GOVERNMENT: 2: DATA USE FOR PLANNING AT NATIONAL LEVEL

G. Bager, G. Sicherman, D. Vallet, P. Gremion, and H. Jamous 1976 186 p refs 3 Vol.

(PB-261302/4; DFD-1976:2) Avail: NTIS HC A09/MF A01; HC also avail. in set of 3 reports PC E10, PB-261300-SET CSCL 05B

Data use for planning was examined in Hungary, Canada, and France, and many of the relationships between models, data collection and processing, and data distribution mechanisms are reviewed, in the course of considering the impact of computers on modeling, the needs for adequate data bases, and the connecting links to the decision process in the economy and in administration. It is concluded that more effective information use can be achieved by the coordination of data collection and distribution systems to integrate data from disparate sources to meet decision-makers' needs and reduce costs in data production and analysis. GRA

N77-21993# Data for Development International Association, Marseille (France).
INFORMATION SYSTEMS IN GOVERNMENT: 3: DATA ORGANIZATION AND USE AT LOCAL LEVEL
J. Beresford, P. Billot, H. Hansen, Y. Ollivier, J. Willis, Gunnar Staack, Pierre Chardavoine, Pierre Gremion, and Haroun Jamous 1976 298 p 3 Vol.
(PB-261303/2; DFD-1976:3) Avail: NTIS HC A13/MF A01; HC also avail. in set of 3 reports PC E10, PB-261300-SET CSCL 05B

The urban information systems of Paris, Cologn, Coventry, Wichita Falls, and Lane County-Eugene Oregon were studied. The data needs for planning are emphasized. The effects of social and organizational factors are analyzed. A simple theory of the information system as a social system is proposed. The factors affecting system use common to the cities studied are described and suggestions are offered on how to plan and initiate an information system. Against the background of the political and institutional environment for each case, the objectives of the system studied and its operational characteristics are examined, followed by a description of the use of the system and an analysis of its major operational problems. GRA

N77-21994# National Commission on New Technological Uses of Copyrighted Works, Washington, D. C.
THE 10TH TRANSCRIPT OF COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS MEETING
Nov. 1976 254 p Meeting held at New York, 18 Nov. 1976
(PB-261946/8; CONTU-76-10) Avail: NTIS HC A12/MF A01 CSCL 05B

The copyrightability of computer software is discussed. Included are subcommittee reports on photocopying, software, networks, and data bases. GRA

N77-21995# National Commission on New Technological Uses of Copyrighted Works, Washington, D. C.
THE 9TH TRANSCRIPT OF COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS MEETING, VOLUMES 1 AND 2
Oct. 1976 199 p Meeting held at Arlington, Va., 21 Oct. 1976
(PB-261947/6; CONTU-76-9-Vol-1-2) Avail: NTIS HC A09/MF A01 CSCL 05B

The implications of the revised copyright law as applied to photocopying by special libraries are discussed. Included is a plan for a national periodical bank. Policies of the National Library of Medicine, the Center for Research Libraries, the Linda Hall Library for scientific and technical materials, and the British Library lending division are discussed. GRA

N77-21996# British Library Lending Div., Boston Spa (England).
THE ELECTRONIC JOURNAL: AN ASSESSMENT
A. M. Woodward Nov. 1976 28 p refs
(BLL-BLRD-5322-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

The concept of the electronic journal, whereby scientific information is disseminated via computer networks rather than in printed journals, is reviewed. Author

N77-21997# British Library Lending Div., Boston Spa (England).
THE ON-LINE SEARCH GUIDE PROJECT: A PROTOTYPE FOR A MINICOMPUTER BASED AID TO THE CONSTRUCTION OF SEARCH PROFILES FOR NATURAL LANGUAGE DATA BASES
P. Leggate, B. M. Eaglestone, M. M. Norgett, and C. Tambyraja Mar. 1976 51 p refs
(BLL-BLRD-5318-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

The principles of profile construction for searching machine-readable data bases are discussed. The different types of information required by the profile writer, and their suitability for on-line provision, are described. Of these types of information, the provision of that required for the selection of search terms was chosen as the basis for a prototype on-line search guide. A test file in the subject area of carbohydrates was assembled to assist in the development of the prototype system. Software was written to provide on-line access to the data in the test file. Author

N77-21998# British Library Lending Div., Boston Spa (England).
INDEXES TO EXPERTISE: AN EXAMINATION OF PRACTICAL SYSTEMS. VOLUMES 1 AND 2 Final Report
S. G. Barry Aug. 1976 461 p refs
(BLL-BLRD-5314-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

A general survey was made of 113 existing indexes to individuals' expertise, with more detailed study of 14 of them, was carried out to examine why such indexes are set up, the approaches and methods needed to set up and run them, their usage and usefulness, the problems associated with their establishment and operation, and the costs involved. The results set out the range of options for each aspect of establishing and running expertise index systems as found through the investigation. Some general, basic rules are given which may be applied when such indexes are being designed. Author

N77-21999# British Library Lending Div., Boston Spa (England).
COMPUTER OUTPUT MICROFILM: CHOICE OF PROCESSING AND DUPLICATING METHODS
A. Horder Jul. 1976 33 p refs
(BLL-BLRD-5307-(2113.56F); NRCd-Pub-6;
ISBN-0-85267-103-2) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

The state of the art of processing and duplicating computer output microfilm is reported. The collection and study of film and equipment manufacturers' literature, discussion with manufacturers, and visits to computer output microfilm installations were disclosed. The implications of the choice of duplicating method are discussed with particular reference to diazo and vesicular films, and also the implications of the associated choice of processing method - conventional, partial reversal or full reversal. Author

N77-22000# British Library Lending Div., Boston Spa (England).
ON-LINE RETRIEVAL USING AN IN-HOUSE DATABASE Final Report, Mar. - Aug. 1976
I. S. Simpson 2 Dec. 1976 71 p refs
(BLL-BLRD-5311-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

An investigation carried out to assess the adequacy of an in-house database and a simple program for the teaching of on-line retrieval of information is presented. The programs consisted of a series of introductory lectures on computer principles and search statement formulation followed by a demonstration of terminal use and hands-on experience by all students, using both teletype and visual display units. Sequences of manufactured questions were provided to ensure that adequate and meaningful outputs from a database of limited size relating to social casework were obtained. Questionnaires were administered before, during, and after the program to obtain an indication of students' attitudes and reactions to the problems facing them, to the ease and interest with which they pursued the course, and, retrospectively, to the efficacy of the teaching method. Author

N77-22001# British Library Lending Div., Boston Spa (England).
MINI-COMPUTERS AND BIBLIOGRAPHIC INFORMATION RETRIEVAL
M. Hyman and Eleanor Wallis Jul. 1976 124 p
(BLL-BLRDR-5305-(2113.56F); ISBN-0-85350-144-0)

Copyright. Avail: British Library Lending Div., Boston Spa, Engl.: £5.00

The characteristic features of minicomputers and their differences from the larger machines on which most bibliographic information retrieval systems have so far been based are discussed. The design and operation of mini-computer-based information retrieval systems are described, and the advantages and limitations of alternative approaches are explored. Topics include the relative merits of on-line and batch processing for the various components of the system, and the selection of storage media, file structures, terminal equipment, enquiry languages, and programming languages. The technical features and costs of four model systems illustrate the potential use of minicomputers. A glossary lists the computer and information retrieval terms used in the report. Author

N77-22002# British Library Lending Div., Boston Spa (England).
REPORT OF A WORKSHOP ON MULTILINGUAL SYSTEMS
V. Horsnell Mar. 1976 39 p Workshop held at Dunchurch, 6-7 Oct. 1975
(BLL-BLRDR-5265-(2113.56F); ISBN-0-85350-137-8)
Copyright. Avail: British Library Lending Div., Boston Spa, Engl.: £2.50

The state of the art of multilingual systems both in the United Kingdom and in Europe is assessed. Current areas of research are identified. Topics discussed include: (1) multilingual thesauri; (2) co-ordination of exchange networks; (3) management of exchange networks; (4) alternatives to multilingual thesauri; (5) products of multilingual systems; (6) linguistic principles; and (7) machine translation. Author

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N77-22003*# ECON, Inc., Princeton, N.J.
ECONOMIC BENEFITS OF IMPROVED INFORMATION ON WORLDWIDE CROP PRODUCTION: AN OPTIMAL DECISION MODEL OF PRODUCTION AND DISTRIBUTION WITH APPLICATION TO WHEAT, CORN, AND SOYBEANS
Final Report
John Andrews 15 Mar. 1977 148 p refs
(Contract NASw-2558)
(NASA-CR-152657; Rept-76-243-1) Avail: NTIS HC A07/MF A01 CSCL 05C

An optimal decision model of crop production, trade, and storage was developed for use in estimating the economic consequences of improved forecasts and estimates of worldwide crop production. The model extends earlier distribution benefits models to include production effects as well. Application to improved information systems meeting the goals set in the large area crop inventory experiment (LACIE) indicates annual benefits to the United States of $200 to $250 million for wheat, $50 to $100 million for corn, and $6 to $11 million for soybeans, using conservative assumptions on expected LANDSAT system performance. Author

N77-22004# Louisiana State Univ., Baton Rouge. Center for Wetlands Resources.
THE RELATIONSHIP BETWEEN RESOURCE USE AND ECONOMIC GROWTH. FORCES DETERMINING THE FUTURE
Kenneth E. F. Watt Jun. 1976 23 p
(PB-261786/8; LSU-R-76-008; NOAA-76111003) Avail: NTIS HC A02/MF A01 CSCL 05C

Examination of the economy of the United States reveals that, contrary to the claims of some people, the present state of the economy is poor, and some startling changes have occurred recently. The fundamental explanation for these changes in terms of resource management policies is examined. It was discovered that there were linkages between many national problems that politicians simply do not discuss. Some alternate strategies for solving the problems are considered. GRA

N77-21124*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A MAINTENANCE AND OPERATIONS COST MODEL FOR DSN
R. W. Burt and H. L. Kirkbride *In its* The Deep Space Network 15 Apr. 1977 p 109-114 (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 05C

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N77-22005*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DESIGN TECHNIQUES FOR MODULAR INTEGRATED UTILITY SYSTEMS
Barry M. Wolfer Feb. 1977 78 p refs
(NASA-TM-X-58189; JSC-10747) Avail: NTIS HC A05/MF A01 CSCL 05A

Features basic to the integrated utility system, such as solid waste incineration, heat recovery and usage, and water recycling/treatment, are compared in terms of cost, fuel conservation, and efficiency to conventional utility systems in the same mean-climatic area of Washington, D. C. The larger of the two apartment complexes selected for the test showed the more favorable results in the three areas of comparison. Restrictions concerning the sole use of currently available technology are hypothetically removed to consider the introduction and possible advantages of certain advanced techniques in an integrated utility system; recommendations are made and costs are estimated for each type of system. Author

N77-22006# South Bend Urban Observatory, Ind.
EFFICIENCY AND EFFECTIVENESS OF SOLID WASTE COLLECTION IN THE SOUTH BEND-MISHAWAKA AREA
Final Report
Duane A. Yazel, James D. Lubbers, Wayne F. Echelberger, Jr., and Richard H. Metzcus May 1976 200 p refs
(Contract HUD-H-2196)
(PB-260506/1; UO-LCCM-SOB-76-001) Avail: NTIS HC A09/MF A01 CSCL 13B

An evaluation of the cost-effectiveness of the three types of solid waste collection programs in the South Bend and Mishawaka communities (private, municipal, and municipally contracted) provided the city with conclusions and recommendations for developing a more productive solid waste collection and management plan, and meeting current and future budgetary constraints. GRA

N77-22007# National Swedish Road and Traffic Research Inst., Linkoeping.
ACCIDENT RATE AS A TRAFFIC SAFETY MEASUREMENT. THE ACCIDENT RATE VARIATION IN DIFFERENT ROAD AND LIGHTING CONDITIONS [OLYCKSKVOT SOM TRAFIKSAEKERHETSMAATT. OLYCKSKVOTENS VARIATION UNDER OLIKA VAEGLAGS- OCH LJUSFOERHAALLANDEN]
Goeran Nilsson 1976 88 p In SWEDISH; ENGLISH

summary
(VTI-73) Avail: NTIS HC A05/MF A01

Differences in accident exposure for different lighting conditions and road conditions in various parts of Sweden during different periods of the year are discussed. Accident exposure was measured in terms of the accident rate, i.e., the number of accidents per million kilometers of pair of axles. The network investigated comprises the national road network, and the accident material refers to 1973. Lighting conditions refers to daylight/darkness, and road conditions refers to bare ground/ice or snow. Based on traffic counts on the national road network during 1973, vehicle mileage could be distributed on these various external conditions as well as on region and month. The accident data was correspondingly distributed. In this way it was possible to express accident exposure with the aid of accident rates for various external conditions. Author (ESA)

N77-22008# Gilbert Associates, Inc., Reading, Pa.
COMPREHENSIVE SOLID WASTE MANAGEMENT STUDY OF ENERGY AND RESOURCE RECOVERY, CHAUTAUQUA COUNTY, NEW YORK Summary Report
Aug. 1976 21 p Sponsored by the New York State Dept. of Environmental Conservation
(PB-260860/2) Avail: NTIS HC A02/MF A01 CSCL 13B

Resource recovery from wastes generated in Chautauqua County is analyzed. About 8.26 pounds of municipal commercial and industrial solid wastes are generated each day for each person in the County or 192,100 tons per year. By 1985 it is projected that this will increase to 204,715 tons per year. Of these totals, approximately 70% of municipal commercial wastes and 50% of the industrial wastes are combustible and, therefore, present an energy recovery potential. The non-combustible portions present materials recovery potential. The feasibility potential of energy/materials resource recovery from Chautauqua County wastes is evaluated. GRA

N77-22009# Gilbert Associates, Inc., Reading, Pa.
COMPREHENSIVE SOLID WASTE MANAGEMENT STUDY OF ENERGY AND RESOURCE RECOVERY, CHAUTAUQUA COUNTY, NEW YORK
Aug. 1976 414 p refs Sponsored by the New York Dept. of Environmental Conservation
(PB-260861/0) Avail: NTIS HC A18/MF A01 CSCL 13B

A feasibility evaluation of a municipal waste resource recovery system is explored. Topics discussed are: (1) the existing solid waste disposal system and determination of waste quantities for design parameters by a field weighing program; (2) examination of existing and potential energy and materials markets which would utilize the recovered waste products; (3) review of existing energy resource recovery technologies applicable to Chautauqua County energy markets; (4) study of waste transport schemes for various resource recovery processing plant/fuel user locations; (5) determination of specific solid and gaseous refuse derived fuel systems and application to site-specific energy user conditions; and (6) suggested implementation strategy. GRA

N77-22010# Garland Urban Observatory, Tex.
ANIMAL CONTROL: THE DEVELOPMENT OF A DATA BASE Final Report
A. J. Flowers and Johnny Heussner Jun. 1976 28 p refs
(Contract HUD-H-2196)
(PB-260472/6; UO-LCCM-GAR-76-005) Avail: NTIS HC A03/MF A01 CSCL 13B

A survey was conducted to determine the number of owned and unowned pets in Garland, Texas. The data acquired were analyzed to provide a census of the animal population, and to estimate the population growth assuming no programmatic intervention is inaugurated. GRA

N77-22011# Illinois Univ., Urbana-Champaign. Water Resources Center.
A FEASIBILITY DEVELOPMENT STUDY FOR THE REMOVAL OF AMMONIA FROM WASTEWATER USING BIOLOGICALLY REGENERATED CLINOPTILOLITE
Michael J. Semmens Aug. 1976 153 p refs
(Contract DI-14-31-0001-6014)
(PB-260512/9; UILU-WRC-76-0115; W77-01057; OWRT-A-080-ILL(1)) Avail: NTIS HC A08/MF A01 CSCL 13B

Ammonium nitrogen may be readily removed from wastewaters by means of an ammonium selective ion exchanger, clinoptilolite. A process in which nitrifying bacteria were employed to regenerate the exchanger was developed and found to be feasible in both batch and column studies. The mechanism of regeneration was ion exchange followed by nitrification of the liberated ammonium. The influences of salt concentration, salt composition, particle size, dissolved oxygen, aeration tank configuration, and aeration tank size on the rate of regeneration were identified. The selectivity of clinoptilolite for barium, lead, copper, cadmium, and zinc was measured in exchange for sodium. GRA

N77-22012# Resource Analysis, Inc., Cambridge, Mass.
SCIENTIFIC AND TECHNICAL EVALUATION OF THE ENVIRONMENTAL PROTECTION AGENCY'S WASTEWATER FACILITIES PLANNING, BOSTON CASE STUDY. PHASE 1: WATER QUALITY CONSIDERATIONS Final Report
R. Noss, T. Najarian, and D. H. Marks 30 Jul. 1976 324 p refs
(Contract EQ6AD450)
(PB-259582/5; EQ-517614450) Avail: NTIS HC A14/MF A01 CSCL 13B

Problems and shortcomings in the administration of the national water pollution act were identified through a case study of the effectiveness of planning for waste water treatment facility construction grants in Boston. Water quality considerations are presented. GRA

N77-22013# King Research, Inc., Rockville, Md. Center for Quantitative Sciences.
STATISTICAL INDICATORS OF SCIENTIFIC AND TECHNICAL COMMUNICATION, 1960 - 1980. VOLUME 1: A SUMMARY REPORT
Donald W. King May 1976 100 p refs
(Contract NSF C-878)
(PB-260374/4) Avail: NTIS HC A05/MF A01 CSCL 05B

Statistical indicators of scientific and technical communication are provided for use by planning and policy decision makers and managers of STI services. An analysis of past trends as well as projections to 1980 are included. GRA

N77-22014# Tennessee Univ., Knoxville. Water Resources Research Center.
IDENTIFICATION AND QUANTIFICATION OF WATER QUALITY CHANGE INDUCING MECHANISMS IN STRATIFIED RESERVOIRS
John A. Gordon (Tennessee Technological Univ.) 6 Oct. 1976 121 p refs
(Contract DI-14-31-0001-5043; OWRT Proj. A-040-TENN(1))
(PB-261366/9; W77-02089) Avail: NTIS HC A06/MF A01 CSCL 08H

Several mechanisms causing water quality changes in a deep stratified reservoir were identified and, in many cases, quantified. These mechanisms included several processes responsible for dissolved oxygen depletion, nitrogen transformation, and addition of water quality constituents from the benthic muds. GRA

N77-22015# Metropolitan Council of the Twin Cities Area, St. Paul, Minn.
THE POLITICS AND PLANNING OF A METROPOLITAN GROWTH POLICY FOR THE TWIN CITIES/AN EXECUTIVE SUMMARY Final Report
Sep. 1976 18 p refs Sponsored by HUD
(PB-260604/4; TCDF-76/1) Avail: NTIS HC A02/MF A01 CSCL 13B

The Metropolitan Council's political and technical experience in developing a growth management policy plan and a framework for its development in the 7-county Twin Cities Metropolitan area is described. Insights gained during the process that may be of use to regional planners and politicians in other areas are discussed. GRA

N77-22016# Illinois State Dept. of Business and Economic Development, Springfield. Div. of Energy.
ENERGY RECOVERY FROM SOLID WASTE: A REVIEW OF CURRENT TECHNOLOGY Final Report

Dugald O. Black Jul. 1976 68 p refs
(PB-260633/3; NSF/IDOE-76-05) Avail: NTIS HC A04/MF A01 CSCL 10A

Processes for converting and utilizing energy from solid wastes are described along with the economic factors and relative advantages of each process. GRA

N77-22017# Rice Center for Community Design and Research, Houston, Tex.
ENVIRONMENTAL DESIGN RESEARCH, 1976: A SUMMARY OF FIVE REGIONAL ENVIRONMENTAL DESIGN CONFERENCES HELD IN THE UNITED STATES DURING JUNE 1976 Final Report
Donald L. Williams, Jack Linville, and Carl P. Sharpe Oct. 1976 68 p refs
(Grant NSF ENV-76-18026)
(PB-261148/1) Avail: NTIS HC A04/MF A01 CSCL 13B

The emerging state of the art of research into man-physical environment relationships, short-comings in such research programs, and an agenda for further exploration are discussed. GRA

N77-22018# URS Research Co., San Mateo, Calif.
PROCEDURES FOR EVALUATING OPERATIONS OF WATER MONITORING NETWORKS
Ruth W. Shnider and Edwin S. Shapiro Sep. 1976 81 p refs
(Contract EPA-68-03-0473)
(PB-260920/4; URS-7431; EPA-60014-76-050) Avail: NTIS HC A05/MF A01 CSCL 13B

The efficiency of surface-water quality monitoring networks whose primary objective is to document compliance with or progress toward attaining ambient water quality standards is evaluated. The manual provides methods to evaluate the efficiency of each of seven operational areas: Network Plan and Design, Personnel, Facilities and Equipment, Sampling Quality Assurance, Data Distribution and Dissemination, and Agency Interactions. GRA

N77-22019# American Society of Civil Engineers, New York. Urban Water Resources Research Council.
URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN THE UNITED KINGDOM
M. J. Lowing (Inst. of Hydrol., Oxon (Engl.) Jul. 1976 31 p refs
(Grant NSF ENG-74-20326)
(PB-262069/8; TM-IHP-4) Avail: NTIS HC A03/MF A01 CSCL 13B

The effects of urbanization on the hydrological regime and water quality in the United Kingdom were investigated to support the International Hydrological Program. Models of underground conduit drainage systems and their evaluation are presented. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N77-22020*# Princeton Univ., N.J. Dept. of Astrophysical Sciences.
LARGE, HIGH RESOLUTION INTEGRATING TV SENSOR FOR ASTRONOMICAL APPLIATIONS Final Report, 1 Jan. 1975 - 31 Aug. 1976
Lyman Jr. Spitzer 10 Jan. 1977 156 p refs
(Contract NAS5-20833)
(NASA-CR-152467) Avail: NTIS HC A08/MF A01 CSCL 03A

A magnetically focused SEC tube developed for photometric applications is described. Efforts to design a 70 mm version of the tube which meets the ST f/24 camera requirements of the space telescope are discussed. The photometric accuracy of the 70 mm tube is executed to equal that of the previously developed 35 mm tube. The tube meets the criterion of 50 percent response at 20 cycles/mm in the central region of the format, and, with the removal of the remaining magnetic parts, this spatial frequency is expected over almost all of the format. Since the ST f/24 camera requires sensitivity in the red as well as the ultraviolet and visible spectra, attempts were made to develop tubes with this ability. It was found that it may be necessary to choose between red and u.v. sensitivity and tradeoff red sensitivity for low background. Results of environmental tests indicate no substantive problems in utilizing it in a flight camera system that will meet the space shuttle launch requirements. D.M.L.

N77-22021*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OBSERVATION OF THE X-RAY SOURCE SCO X-1 FROM SKYLAB
Robert M. Wilson Feb. 1977 20 p refs
(NASA-TM-X-73376) Avail: NTIS HC A02/MF A01 CSCL 03A

An attempt to observe the discrete X-ray source Sco X-1 on 20 September 1973 between 0856 and 0920 UT is reported. Data obtained with the ATM/S-056 X-ray event analyzer, in particular the flux observed with the 1.71 to 4.96 KeV counter, is analyzed. No photographic image of the source was obtained because Sco X-1 was outside the field of view of the X-ray telescope. Author

N77-22022*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
A VERSATILE DETECTOR SYSTEM TO MEASURE THE CHANGE STATES, MASS COMPOSITIONS AND ENERGY SPECTRA OF INTERPLANETARY AND MAGNETOSPHERE IONS
George Gloeckler 1977 41 p refs
(Grants NGR-21-002-224; NGR-21-002-316)
(NASA-CR-152738; TR-043; PP-77-148) Avail: NTIS HC A03/MF A01 CSCL 03A

An instrument is described for measuring the mass and charge state composition as well as the energy spectra and angular distributions of 0.5 to 350 kev/charge ions in interplanetary space and in magnetospheres of planets such as Jupiter and earth. Electrostatic deflection combined with a time-of-flight and energy measurement allows three-parameter analysis of output signals from which the mass, charge states, and energy are determined. Post-acceleration by 30 kV extends the energy range of the detector system into the solar wind and magnetosphere plasma regime. Isotopes of H and He are easily resolved as are individual elements up to Ne and the dominant elements up to and including Fe. This instrument has an extremely large dynamic range in intensity and is sensitive to rare elements even in the presence of high intensity radiation, and is adapted for interplanetary, deep-space, and out-of-the-ecliptic missions, as well as for flights on spacecraft orbiting Jupiter and earth. Author

N77-22023# Los Alamos Scientific Lab., N. Mex.
TRIPLET TRANSITIONS OF NEUTRAL CO IN THE SPECTRA OF COMETS AND THE ABUNDANCE OF CO2 OR MOLECULES CONTAINING THE CO GROUP IN COMETS
L. Biermann (Max-Planck-Institut fuer Physik und Astrophysik, Munich, West Germany) Mar. 1976 8 p refs
(Contract W-7405-eng-36)
(LA-6289-MS) Avail: NTIS HC A02/MF A01

The high-dispersion spectra of comet Mrkos (1957 V) taken at Mt. Palomar contain many unidentified weak lines. The possibility that some of these lines belong to transitions between triplet levels of neutral CO molecules is investigated. Their presence suggests excitation related to the dissociative recombination of a parent containing the CO group, which is first ionized by solar UV. Of 31 CO lines (of the Asundi and Triplet systems), 14 are masked by known or by questionably identified lines as statistically expected. Of the remaining 17, 13 coincide within a few tenths

of an Angstrom with an unidentified line and 4 do not. These results are contrary to statistical expectations. ERA

N77-22024# European Southern Observatory, Hamburg (West Germany).
[ACTIVITIES OF THE EUROPEAN SOUTHERN OBSERVATORY] Annual Report, 1975
L. Woltjer [1976] 52 p refs
Avail: NTIS HC A04/MF A01

Following a brief summary of research activities, the 3.6 meter telescope project is reviewed. Other telescopes and auxiliary instruments are described. The construction program in Chile is summarized together with the administrative business for the year. ESA

N77-22025# Royal Observatory, Edinburgh (Scotland).
[ACTIVITIES CONCERNING NATIONAL FACILITIES AND GALACTIC, EXTRAGALACTIC AND STELLAR RESEARCH] Annual Report, period ending 30 Sep. 1976
1976 47 p refs
(ISBN-0-902553-16-X) Avail: NTIS HC A03/MF A01

The following topics are covered: the UK infrared telescope; the UK schmidt telescope unit; Cosmos; other measuring machines; miscellaneous administration matters; extragalactic research; galactic research; and stellar studies. ESA

N77-22026# Academy of Sciences (USSR), Moscow. Space Research Inst.
THE MAGNETOPAUSE OF AN ACCRETING NEUTRON STAR
M. M. Basko 1976 27 p refs Submitted for publication
(PR-291) Avail: NTIS HC A03/MF A01

The shape of the Alfven surface separating the magnetosphere of the neutron star from the freely falling plasma, as well as the velocity and the optical depth of the gaseous shell on this surface, were calculated in dust approximation. Both the radial infall and disk accretion are discussed. Beneath the Alfven radius accreting plasma is shown to be necessarily frozen into the stellar magnetic field. Author (ESA)

N77-22027# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
AN ERROR ANALYSIS FOR ABSOLUTE FLUX DENSITY MEASUREMENTS OF CASSIOPEIA A
Motohisa Kanda 27 Feb. 1976 12 p refs Repr. from IEEE Trans. on Instr. and Meas., v. IM-25, no. 3, Sep. 1976 p 173-182 Sponsored in part by Army Commun. Command
(PB-260815/6) Avail: NTIS HC A02/MF A01 CSCL 03B

An error analysis for absolute flux density measurements of Cas A is discussed. The lower-bound quadrature-accumulation error for state-of-the-art measurements of the absolute flux density of Cas A around 7 GHz is estimated to be 1.71 percent for 3 sigma limits. The corresponding practicable error for the careful but not state-of-the-art measurements is estimated to be 4.46 percent for 3 sigma limits. GRA

N77-22028# National Bureau of Standards, Washington, D. C. Molecular Spetroscopy Section.
DETECTION, IDENTIFICATION, AND OBSERVATIONS OF INTERSTELLAR H13CO(+) Final Report
L. E. Snyder (Ill. Univ., Urbana-Champaign), J. M. Hollis (Va. Univ.), F. J. Lovas, and B. L. Ulich (Natl. Radio Astronomy Obs.) 27 Feb. 1976 10 p refs Repr. from Astrophys. J., v. 209, no. 1, 1 Oct 1976 p 67-74 Submitted for publication Sponsored in part by NSF
(PB-261206/7) Avail: NTIS HC A02/MF A01 CSCL 03B

Observations of interstellar H13CO(+) are presented and results of the molecular structure computations supporting this particular molecular identification are given. Preliminary values of integrated intensity ratios of H12 CO(+)/H13 CO(+) have been found for the main HCO(+) clouds. Searches for H12 CO18(+) were unsuccessful and upper limits are given. U86.76, a new unidentified interstellar molecule which may be methylcyanocetylene, was detected in Sgr B2. GRA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N77-22029*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TECHNIQUES OF GLOBAL ANALYSIS APPLIED TO GRAVITATION THEORIES: A COSMOLOGICAL BLACK HOLE?
George Debney Feb. 1977 19 p refs
(NASA-TM-X-73378) Avail: NTIS HC A02/MF A01 CSCL 03B

An elementary model of freely falling observers and emitters within a black hole's radius is examined to determine the redshift spectrum reaching a typical observer. The model is independent of scale, the fundamental unit being the radius (mass) of the black hole. The observers/emitters all follow the same kinds of trajectories: radially inward and starting from rest at spatial infinity. The test-particle role is assumed throughout; i.e., the observers/emitters do not themselves contribute to the gravitational field of the system. By means of redshift formulas and luminosity distance to the emitters, a picture of actual redshifts and blueshifts, with their intensities, emerges for an observer within the black hole's radius. No luminosity distances greater than approximately one-half the radius are considered in this particular study; nevertheless, redshifts and blueshifts up to approximately 0.6 are seen in portions of the observer's celestial sphere. An exotic application can be made, as a curiosity, to a black hole the size of the universe, resulting in a particular anisotropic 'cosmology.' Author

N77-22030*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SMALL SCALE TURBULENCE IN THE CRAB NEBULA: EVIDENCE OF LOWER HYBRID PARAMETRIC INSTABILITIES DRIVEN BY THE PULSAR WAVE
Lou-Chuang Lee Mar. 1977 15 p refs Submitted for publication
(NASA-TM-X-71295; X-602-77-69) Avail: NTIS HC A02/MF A01 CSCL 03B

Strong small scale turbulence is observed in the Crab Nebula from the temporal pulse broadening data. It is shown that the strong 30 Hz pulsar wave can parametrically excite instabilities near the lower hybrid frequency in the thermal plasma of the Crab Nebula with a characteristic wavelength of the order of the scale size a of the turbulence observed. These instabilities provided a coupling mechanism between the pulsar wave and the Nebula plasma. Author

N77-22031*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC FIELD EXPERIMENT FOR VOYAGERS 1 AND 2
K. W. Behannon, M. H. Aluna, L. F. Burlaga, R. P. Lepping, N. F. Ness, and F. M. Neubauer (Technische Universitaet, Brunswick) Mar. 1977 44 p refs
(NASA-TM-X-71297; X-692-77-16) Avail: NTIS HC A03/MF A01 CSCL 03B

The magnetic field experiment to be carried on the Voyager 1 and 2 missions consists of dual low field (LFM) and high field magnetometer (HFM) systems. The dual systems provide greater reliability and, in the case of the LFM's, permit the separation of spacecraft magnetic fields from the ambient fields. Additional reliability is achieved through electronics redundancy. The wide dynamic ranges of plus or minus 0.5G for the LFM's and plus or minus 20G for the HFM's, low quantization uncertainty of plus or minus 0.002 gamma in the most sensitive (plus or minus 8 gamma) LFM range, low sensor RMS noise level of 0.006 gamma, and use of data compaction schemes to optimize the experiment information rate all combine to permit the study of a broad spectrum of phenomena during the mission. Planetary fields at Jupiter, Saturn, and possibly Uranus; satellites of these planets; solar wind and satellite interactions with the planetary fields; and the large-scale structure and microscale characteristics of the interplanetary magnetic field are studied. The interstellar field may also be measured. Author

N77-22032# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
IS THE UNIVERSE MATTER-ANTIMATTER SYMMETRIC?
Hannes Alfven Sep. 1976 24 p refs Presented at the Particle Phys. Symp., Stockholm, 12 Jul. 1976
(TRITA-EPP-76-14) Avail: NTIS HC A02/MF A01

Arguments in favor of a symmetric picture of the universe where antimatter regions are equally as large as those of matter (koino-matter) and each region separated by Leidenfrost layers are presented. Space research in the magnetosphere and interplanetary space confirmed the existence of thin layers dividing space into regions of different magnetization and as a result a cellular structure for both the interstellar space and intergalactic space was assumed, corroborating the symmetric cosmology concept. The possibility that every second star in the galaxy consists of antimatter is discussed, and it is shown that this view is not in conflict with any observations. As most stars are likely to be surrounded by solar systems of a structure similar to our own, it is concluded that collisions between comets and antistars (or anticomets and stars) would be rather frequent. Such collisions would result in phenomena of the same type as the observed cosmic gamma-ray bursts. Another support for the symmetric cosmology is the continuous X-ray background radiation. Also, many of the observed large energy releases in the cosmos are likely to be due to annihilation. Author (ESA)

N77-22033# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
MAGNETIC FIELD DATA ANALYSIS FOR THE ROME-GSFC EXPERIMENT ONBOARD HELIOS A AND B
B. Bavassano Jul. 1976 50 p refs
(LPS-76-18) Avail: NTIS HC A03/MF A01

The Helios A and B spacecraft are described, together with the experiment modes of operation for the Rome-GSFC onboard magnetic field experiment. The computer programs for data analysis and the contents of the output magnetic tapes are explained. ESA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N77-22034*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
INTRODUCTION TO THE APOLLO COLLECTIONS. PART 1: LUNAR IGNEOUS ROCKS
Patricia E. McGee (Lockheed Electronics Co.), Jeffrey L. Warner, and Charles H. Simonds (Lunar Science Inst.) Feb. 1977 99 p refs
(NASA-TM-X-74633) Avail: NTIS HC A05/MF A01 CSCL 03B

The basic petrographic, chemical, and age data is presented for a representative suite of igneous rocks gathered during the six Apollo missions. Tables are given for 69 samples: 32 igneous rocks and 37 impactites (breccias). A description is given of 26 basalts, four plutonic rocks, and two pyroclastic samples. The textural-mineralogic name assigned each sample is included.
Author

N77-22035*# Battelle Pacific Northwest Labs., Richland, Wash.
MEASUREMENTS OF RADON CONCENTRATIONS IN THE LUNAR ATMOSPHERE
R. L. Brodzinski, P. O. Jackson, and J. C. Langford 31 Mar. 1977 17 p refs
(Contract NAS9-1326(t))
(NASA-CR-151327; BN-SA-723) Avail: NTIS HC A02/MF A01 CSCL 03B

The radon concentrations in the lunar atmosphere were determined by measuring the Po-210 progeny activity in artifacts returned from the moon. Experiments performed on a section of the polished aluminum strut from Surveyor 3 and data obtained from the Apollo 16 Cosmic Ray Detector Experiment Teflon thermal shield are compared with other values of the lunar radon concentration obtained at different times and different locations and by various techniques. Possible sources and release mechanisms compatible with all of the data are discussed. An experimental procedure to determine the relative retention coefficients of various types of material for radon progeny in a simulated lunar environment is described. The results of several experiments are given, and their effect on lunar radon progeny measurements is discussed. An analytical procedure is given for the analysis of a Teflon matrix for trace constituents. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N77-22036*# TRW Systems, Redondo Beach, Calif.
STRUCTURE OF A QUASI-PARALLEL, QUASI-LAMINAR BOW SHOCK
E. W. Greenstadt, C. T. Russell (Calif. Univ., Los Angeles), V. Formisano (CNR-LPS Lab. Plasma Spazio, Frascati, Italy), P. C. Hedgecock (Imp. Coll. of Sci. and Technol., London), F. L. Scarf, M. Neugebauer (JPL), and R. E. Holzer (Calif. Univ., Los Angeles) Jul. 1976 159 p refs
(Contract NASw-2398)
(NASA-CR-152658) Avail: NTIS HC A08/MF A01 CSCL 03B

A thick, quasi-parallel bow shock structure was observed with field and particle detectors of both HEOS 1 and OGO 5. The typical magnetic pulsation structure was at least 1 to 2 earth radii thick radially and was accompanied by irregular but distinct plasma distributions characteristic of neither the solar wind nor the magnetosheath. Waves constituting the large pulsations were polarized principally in the plane of the nominal shock, therefore also in the plane perpendicular to the average interplanetary field. A separate interpulsation regime detected between bursts of large amplitude oscillations was similar to the upstream wave region magnetically, but was characterized by disturbed plasma flux and enhanced noise around the ion plasma frequency. The shock structure appeared to be largely of an oblique, whistler type, probably complicated by counterstreaming high energy protons. Evidence for firehose instability-based structure was weak at best and probably negative. Author

N77-22037# Academy of Sciences (USSR), Moscow. Space Research Inst.
THE SHAPE AND ENERGY OF THE SHOCK WAVES FROM SOLAR FLARES ON 2, 4 AND 7 AUGUST 1972
G. N. Zastenker, V. V. Temny (Centre d'Etude Spatiale des Rayonnements), and C. Duston 1976 24 p refs
(PR-294) Avail: NTIS HC A02/MF A01

The shape of shock waves associated with solar flares were determined from a comparison of plasma measurement data from Prognoz, Prognoz 2, Pioneer 9, and Pioneer 10 space probes with the observations of the radio source scintillations and comet brightness. A nearly spherical shock wave shape was obtained for two flares on August 2, and essentially nonspherical ones for flares on August 4 and 7. The energy and ejected mass quantities obtained from Prognoz 2 measurements of the additional energy flux and mass flux behind each shock wave are reported. From the comparison of Prognoz 2 and Pioneer 9 data the significant energy flux maximum near the flare's meridian on the shock wave front was observed for the August 4 flare.
Author (ESA)

N77-22038*# National Bureau of Standards, Boulder, Colo. Astrophysics Div.
THE Mg II h AND k LINES. II. COMPARISON WITH SYNTHESIZED PROFILES AND Ca II K Final Report
T. R. Ayres (Center for Astrophysics, Cambridge, Mass.) and J. L. Linsky 11 Aug. 1975 25 p refs Repr. from Astrophysical Jnl., vol. 205, no. 3, 1 May 1976 p 874-894
(Contract NAS5-23274; Grant NGL-06-003-057)
(NASA-CR-152682; PB-259336/6) Avail: NTIS

HC A02/MF A01 CSCL 03B

The Mg II h and k resonance line data and profiles of the Ca II K line are compared with synthetic profiles computed using a partial redistribution formalism and several single-component solar upper photosphere and lower chromosphere models. It is found that second models predict systematically lower intensities in the h, k, and K inner wings than are observed, but that models with a somewhat larger minimum temperature (T(min) about 4450 K) can reproduce the measured inner wing intensities and limb darkening of these resonance lines. A 'hot' T(min) solar model, which is reasonably consistent with the empirical emission cores and wing intensities of the Ca II and Mg II resonance lines is proposed to serve as an alternative to the class of models, such as the HSRA and VAL, based on continuum observations. GRA

N77-21129*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING S-BAND DOPPLER RMS PHASE FLUCTUATIONS USED TO CALIBRATE THE MEAN 1976 EQUATORIAL CORONA
A. L. Berman and J. A. Wackley *In its* The Deep Space Network 15 Apr. 1977 p 152-166 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

N77-21130*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING DOPPLER NOISE USED TO DETERMINE THE RADIAL DEPENDENCE OF ELECTRON DENSITY IN THE EXTENDED CORONA
A. L. Berman, J. A. Wackley, S. T. Rockwell, and M. Kwan *In its* The Deep Space Network 15 Apr. 1977 p 167-171 refs (For primary document see N77-21110 12-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N77-22039*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GALACTIC HALO QUESTION: NEW SIZE CONSTRAINTS FROM GALACTIC GAMMA-RAY DATA
F. W. Stecker and F. C. Jones Mar. 1977 41 p refs Submitted for publication
(NASA-TM-X-71281; X-602-77-73) Avail: NTIS HC A03/MF A01 CSCL 03B

The SAS-2 gamma-ray data is analyzed making use of recent CO line emission and other data for determining the large-scale distribution of galactic gas. A nonuniform distribution of cosmic rays in the galaxy is implied. This fact rules out large trapping halo models and extragalactic origin models. Detailed models of diffusion halos of various sizes perpendicular to the galactic plane are considered. In such models, the scale perpendicular to the plane has a strong effect in determining the radial distribution of cosmic rays. Such radial distributions are calculated for cylindrical coordinate models. The implied gamma-ray longitude distributions are then calculated and compared with the SAS-2 data for goodness-of-fit. Assuming the sources to be supernova remnants or pulsars, cosmic ray nucleon halo models with scale heights greater than 3 kpc are found to provide a poor fit to the gamma-ray longitude data (probability of 6% or less). Thin halo, or source dominated diffusion models are found to provide a good fit to the gamma-ray data, with an upper limit scale height of approximately 3 kpc. Author

N77-22040*# Indian National Scientific Documentation Centre, New Delhi.
SOLAR COSMIC RAYS
L. I. Dorman and L. I. Miroshnichenko 1976 593 p refs Transl. into ENGLISH of the book "Solnechnye kosmicheskie luchi", Moscow, Izdatel'stvo Nauka, 1968 Sponsored by NASA (Contract NSF C-466)
(NASA-TT-F-674; TT-70-57262) Avail: NTIS HC A25/MF A01 CSCL 03B

Experimental data on solar cosmic rays obtained during 1942-1967 with the help of ground apparatus for continuous recording of cosmic rays (neutron monitors, ionization chambers, scintillation telescopes) is systematized and analyzed. Stratospheric data and the data gathered from satellite and rocket-borne instruments are also investigated. Problems of generation and propagation of solar cosmic rays, in particular, the question regarding the form of representation of energy spectrum of solar particles (power and exponential function of rigidity), are examined, and the dependence of diffusion coefficient on energy of the particles and distance from the sun discussed. Additional topics include the physics of solar flares, prediction of flares emitting energetic particles, and the protection of astronauts from solar flare protons. A bibliography is included. Author

N77-22041# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
COSMIC RAY NM-64. NEUTRON MONITOR DATA-4, JANUARY-DECEMBER 1975
G. Villoresi, N. L. Zangrilli, M. Parisi, M. Storini, A. Felici, F. Re, and F. Signoretti Nov. 1976 35 p
(LPS-76-30) Avail: NTIS HC A03/MF A01

Pressure-corrected data from the Rome neutron monitor and barometric pressure data are presented in tabular form, together with graphs of the corrected intensity. Details on the devices employed, operational mode, and data handling are given.
Author (ESA)

99 GENERAL

No abstracts in this category.

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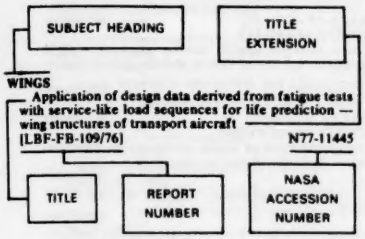

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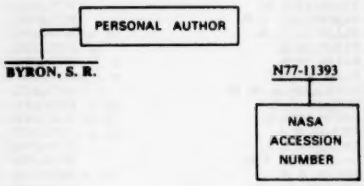

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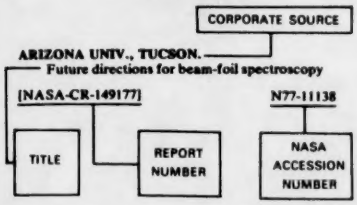

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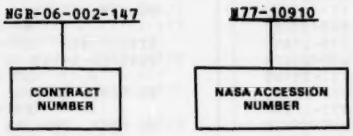

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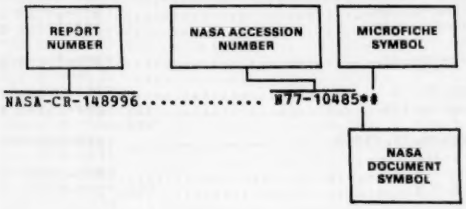

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L-11162 ..... N77-21404*#

LA-UR-76-994 ..... N77-21859 #
LA-UR-76-1790 ..... N77-21198 #
LA-UR-76-1809 ..... N77-21325 #
LA-UR-76-1810 ..... N77-21333 #
LA-UR-76-1811 ..... N77-21952 #
LA-UR-76-1837 ..... N77-21956 #
LA-UR-76-1843 ..... N77-21950 #
LA-UR-76-1875 ..... N77-21951 #
LA-UR-76-1881 ..... N77-21954 #
LA-UR-76-1882 ..... N77-21953 #

LA-6236 ..... N77-21370 #
LA-6289-MS ..... N77-22023 #
LA-6342 ..... N77-21371 #
LA-6371 ..... N77-21345 #
LA-6392-T ..... N77-21372 #
LA-6395-MS ..... N77-21919 #
LA-6412-MS ..... N77-21947 #
LA-6440-MS ..... N77-21868 #
LA-6446-MS ..... N77-21948 #

LA-6465-MS ..... N77-21949 #
LA-6469-MS ..... N77-21774 #
LA-6492-MS ..... N77-21867 #

LAKS-IN-120776 ..... N77-21521*#

LBL-4495 ..... N77-21532 #
LBL-4844 ..... N77-21671 #
LBL-5120 ..... N77-21933 #
LBL-5310 ..... N77-21988 #
LBL-5462 ..... N77-21406 #

LC-25-26527 ..... N77-21266 #
LC-76-43525 ..... N77-21543 #
LC-76-600068 ..... N77-21106*

LEC-8377 ..... N77-21787*#

LHC-760504-A ..... N77-21711 #

LMSC-D386845 ..... N77-21248*#

LPS-76-18 ..... N77-22033 #
LPS-76-20 ..... N77-21776 #
LPS-76-28 ..... N77-21777 #
LPS-76-29 ..... N77-21971 #
LPS-76-30 ..... N77-22041 #

LR-27153 ..... N77-21467*#
LR-27230 ..... N77-21468*#

LRP-110/76 ..... N77-21958 #

LSU-P-76-008 ..... N77-22004 #

LTP-34 ..... N77-21436 #

LTR-UA-28 ..... N77-21734 #
LTR-UA-37 ..... N77-21800 #

LTSS-304-ED-2-PT-4 ..... N77-21858 #

M-213 ..... N77-21802*#
M-492-302-77-01 ..... N77-21152*

MARMAP-CONTRIB-136 ..... N77-21512*#

MATT-1273 ..... N77-21966 #

MBL-1976-5 ..... N77-21833 #
MBL-1976-9 ..... N77-21836 #
MBL-1976-14 ..... N77-21832 #

MDC-G6741-VOL-1 ..... N77-21179*#
MDC-G6741-VOL-2 ..... N77-21180*#
MDC-G6741-VOL-3 ..... N77-21181*#
MDC-G6741-VOL-4 ..... N77-21182*#

MHSMP-76-30N ..... N77-21407 #
MHSMP-76-30P ..... N77-21249 #

MITSG-77-1 ..... N77-21819 #

MLM-2363(OP) ..... N77-21458 #

MML-TR-76-84C ..... N77-21233 #

MPI-PAE/EXTRATERR-125 ..... N77-21968 #

MPIS-MITT-62 ..... N77-21053 #

MRC-DA-556 ..... N77-21758 #

MRC-TSR-1649 ..... N77-21982 #

MTR-7137 ..... N77-21683 #

NAPD-TM-1196 ..... N77-21869 #

NASA-CASE-GSC-12146-1 ..... N77-21322*#

NASA-CASE-KSC-11008-1 ..... N77-21321*#
NASA-CASE-KSC-11018-1 ..... N77-21320*#
NASA-CASE-KSC-11031-1 ..... N77-21319*#
NASA-CASE-KSC-11034-1 ..... N77-21666*#

NASA-CASE-LAR-11390-1 ..... N77-21267*
NASA-CASE-LAR-12183-1 ..... N77-21424*#

NASA-CASE-LEW-12543-1 ..... N77-21217*#

NASA-CASE-MFS-23074-1 ..... N77-21844*

NASA-CASE-MSC-16182-1 ..... N77-21847*#

NASA-CASE-NPO-10189-1 ..... N77-21314*
NASA-CASE-NPO-10619-1 ..... N77-21393*
NASA-CASE-NPO-10711-1 ..... N77-21392*
NASA-CASE-NPO-10781-1 ..... N77-21314*
NASA-CASE-NPO-10790-1 ..... N77-21316*
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NASA-CASE-NPO-11510-1 ..... N77-21315*

NASA-CR-2710 ..... N77-21099*#
NASA-CR-2730 ..... N77-21887*#
NASA-CR-2787 ..... N77-21473*#
NASA-CR-2788 ..... N77-21100*#
NASA-CR-2802 ..... N77-21363*#
NASA-CR-2803 ..... N77-21894*#
NASA-CR-2815 ..... N77-21403*#
NASA-CR-2816 ..... N77-21050*#
NASA-CR-2823 ..... N77-21975*#
NASA-CR-2826 ..... N77-21802*#
NASA-CR-15264 ..... N77-21513*#
NASA-CR-134956 ..... N77-21467*#
NASA-CR-134957 ..... N77-21468*#
NASA-CR-135007 ..... N77-21248*#
NASA-CR-135052 ..... N77-21360*#
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NASA-CR-135155 ..... N77-21092*#
NASA-CR-135158 ..... N77-21551*#
NASA-CR-135162 ..... N77-21089*#
NASA-CR-135163 ..... N77-21190*#
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NASA-CR-135175 ..... N77-21048*#
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NASA-CR-145135 ..... N77-21866*#
NASA-CR-145166 ..... N77-21519*#
NASA-CR-145305 ..... N77-21074*#
NASA-CR-146973 ..... N77-21194*#
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NASA-CR-150217 ..... N77-21790*#
NASA-CR-150220 ..... N77-21801*#
NASA-CR-150228 ..... N77-21317*#
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NASA-CR-151982 ..... N77-21366*#
NASA-CR-151993 ..... N77-21084*#
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NASA-CR-152736 ..... N77-21213*#
NASA-CR-152737 ..... N77-21108*#
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NASA-SP-413 ..... N77-21106*
NASA-SP-415 ..... N77-21022*#

NASA-TM-X-3460 ..... N77-21098*#
NASA-TM-X-3470 ..... N77-21368*#
NASA-TM-X-3480 ..... N77-21282*#
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NASA-TM-X-3513 ..... N77-21049*#
NASA-TM-X-3520 ..... N77-21735*#
NASA-TM-X-3521 ..... N77-21051*#
NASA-TM-X-58189 ..... N77-22005*#
NASA-TM-X-71280 ..... N77-21151*#
NASA-TM-X-71281 ..... N77-22039*#
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NASA-TM-X-71287 ..... N77-21526*#
NASA-TM-X-71288 ..... N77-21528*#
NASA-TM-X-71289 ..... N77-21137*#
NASA-TM-X-71290 ..... N77-21529*#
NASA-TM-X-71295 ..... N77-22030*#
NASA-TM-X-71296 ..... N77-21818*#
NASA-TM-X-71297 ..... N77-22031*#
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NASA-TM-X-71300 ..... N77-21281*#
NASA-TM-X-72609 ..... N77-21768*#
NASA-TM-X-73195 ..... N77-21071*#
NASA-TM-X-73212 ..... N77-21020*#
NASA-TM-X-73225 ..... N77-21921*#
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NASA-TM-X-73376 ..... N77-22021*#
NASA-TM-X-73378 ..... N77-22029*#
NASA-TM-X-73570 ..... N77-21518*#
NASA-TM-X-73616 ..... N77-21193*#
NASA-TM-X-73617 ..... N77-21087*#
NASA-TM-X-73619 ..... N77-21788*#
NASA-TM-X-73637 ..... N77-21548*#
NASA-TM-X-73638 ..... N77-21549*#
NASA-TM-X-74011 ..... N77-21047*#
NASA-TM-X-74015 ..... N77-21261*#
NASA-TM-X-74017 ..... N77-21469*#
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NASA-TM-X-74021 ..... N77-21090*#
NASA-TM-X-74023 ..... N77-21400*#
NASA-TM-X-74024 ..... N77-21396*#
NASA-TM-X-74608 ..... N77-21767*#
NASA-TM-X-74609 ..... N77-21152*
NASA-TM-X-74614 ..... N77-21515*#
NASA-TM-X-74630 ..... N77-21422*#
NASA-TM-X-74632 ..... N77-21203*#
NASA-TM-X-74633 ..... N77-22034*#
NASA-TM-X-74643 ..... N77-21780*#
NASA-TM-X-74680 ..... N77-21136*#
NASA-TM-X-74681 ..... N77-21139*#
NASA-TM-X-74682 ..... N77-21791*#
NASA-TM-X-74683 ..... N77-21153*#

NASA-TN-D-8370 ..... N77-21404*#
NASA-TN-D-8404 ..... N77-21441*#
NASA-TN-D-8461 ..... N77-21216*#
NASA-TN-D-8465 ..... N77-21444*#

NASA-TT-F-674 ..... N77-22040*#
NASA-TT-F-16773 ..... N77-21398*#
NASA-TT-F-16774 ..... N77-21902*#
NASA-TT-F-16775 ..... N77-21825*#
NASA-TT-F-17403 ..... N77-21852*#
NASA-TT-F-17415 ..... N77-21361*#
NASA-TT-F-17420 ..... N77-21201*#
NASA-TT-F-17431 ..... N77-21399*#
NASA-TT-F-17524 ..... N77-21109*#
NASA-TT-F-17535 ..... N77-21082*#

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NBS-TN-931 ..... N77-21927 #

NBSIR-76-1029 ..... N77-21710 #

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NELC-TR-2002 ..... N77-21292 #

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NIH-NO1-HV-4-2950 ..... N77-21840 #

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NIWARS-PUBL-19 ..... N77-21413 #

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NLR-MP-76005-U ..... N77-21910 #
NLR-MP-76013-U ..... N77-21061 #
NLR-MP-76024-U ..... N77-21481 #

NLR-TR-76039-U ..... N77-21411 #
NLR-TR-76041-U ..... N77-21897 #

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NOAA-TR-EDS-15 ..... N77-21502 #

NOAA-TR-NESS-74 ..... N77-21812 #

NOAA-76092301 ..... N77-21208 #
NOAA-76100603 ..... N77-21812 #
NOAA-76101302 ..... N77-21541 #
NOAA-76101304 ..... N77-21502 #
NOAA-76111001 ..... N77-21819 #
NOAA-76111003 ..... N77-22004 #
NOAA-76111016 ..... N77-21816 #
NOAA-76111034 ..... N77-21813 #

NPL-COM-SCI-82 ..... N77-21860 #

NPL-COM-83 ..... N77-21990 #
NPL-COM-85 ..... N77-21889 #

NPL-NAC-68 ..... N77-21915 #
NPL-NAC-70 ..... N77-21890 #

NPS-55JS76031 ..... N77-21945 #

NBCD-PUB-6 ..... N77-21999 #

NBL-MR-3352 ..... N77-21105 #
NBL-MR-3378 ..... N77-21096 #
NBL-MR-3380 ..... N77-21917 #
NBL-MR-3385 ..... N77-21916 #
NBL-MR-3386 ..... N77-21973 #
NBL-MR-3387 ..... N77-21461 #
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NBL-8032 ..... N77-21159 #
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ORNL-CSD-14 ..... N77-21905 #

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ORNL/TM-5535 ..... N77-21935 #
ORNL/TM-5600 ..... N77-21989 #
ORNL/TM-5603 ..... N77-21957 #
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PB-258972/9 ..... N77-21422*#
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PB-259255/8 ..... N77-21703 #
PB-259336/6 ..... N77-22038*#
PB-259582/5 ..... N77-22012 #
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PB-259987/6 ..... N77-21751 #
PB-260364/5 ..... N77-21705 #
PB-260374/4 ..... N77-22013 #
PB-260378/5 ..... N77-21487 #
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PB-260472/6 ..... N77-22010 #
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